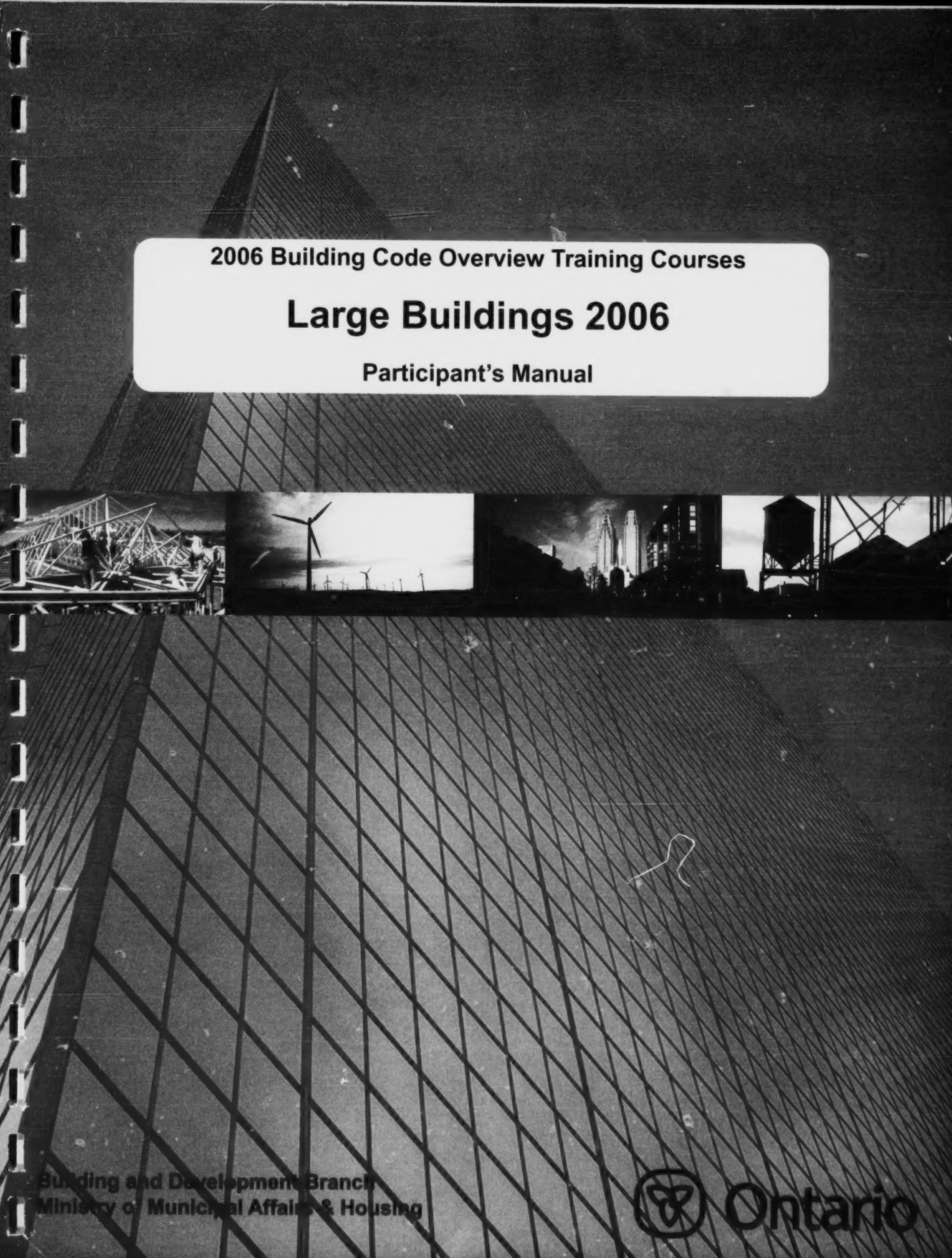
2006 Building Code Overview Training Courses

Large Buildings 2006

Participant's Manual



Building and Development Branch
Ministry of Municipal Affairs & Housing

Ontario

Ontario

Ministry of Municipal Affairs and Housing

LARGE BUILDINGS - 2006

PARTICIPANT / SELF-STUDY MANUAL

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

This course was developed and produced by:

Leber/Rubes Incorporated

for the:

Ontario Ministry of Municipal Affairs and Housing

This course is based on the Building Code Act, S.O. 1992, C.23 as amended to June 22, 2006 and the Ontario Building Code 2006 (O.Reg. 350/06) as amended.

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Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 1

LARGE BUILDINGS - 2006

INTRODUCTION AND INSTRUCTIONS

ADMINISTRATIVE REQUIREMENTS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

COURSE OBJECTIVES

The objective of this course is to help you understand the requirements of the Building Code applicable to large buildings.

Large buildings are defined as all buildings occupying an area greater than ten square metres and

a) used for
   I) Group A, assembly occupancies,
   ii) Group B, care or detention occupancies, or
   iii) Group F, Division 1, high hazard industrial occupancies, and

b) exceeding 600 m^2 in building area or exceeding 3 storeys in building height used for major occupancies classified as
   I) Group C, residential occupancies,
   ii) Group D, business and personal service occupancies,
   iii) Group E, mercantile occupancies, or
   iv) Group F, Divisions 2 and 3, medium and low hazard industrial occupancies, and the building systems, works, fixtures and service systems appurtenant to these buildings.

This course offers a cursory overview of the requirements for large buildings contained in the Code. This includes requirements contained in Division A, Parts 1, 2 and 3; Division B, Parts 1, 3, 4, 5, 6, 7, 9, 11 and 12; Division C, Parts 1 and 2; and Supplementary Standards SA-1, SB-1, SB-2, SB-8 and SB-10.

The Ministry of Municipal Affairs exam syllabus for Large Buildings is found on their website:

http://ontario.ca/buildingcode

under the headings: Qualification & Registration / Examination Syllabi.

Questions on the Ministry's exams are all multiple choice. They have been chosen to address OBC requirements based on the "Difficulty", "Importance" and "Frequency" of the requirement.

Difficulty:	How hard it is to understand, interpret and apply the underlying intent of the provision?
Importance:	How important is the provision in supporting the purpose or objectives of the Code (health, safety, fire protection, structural sufficiency, accessibility, conservation and environmental integrity of the building)?
Frequency:	How often the provision is applied?

The examination questions focus mostly in areas of high relevance (difficulty, importance and frequency) and are geared to assess a candidate's ability to find, understand and apply these provisions.

Find:	Search the Code and find or identify a Code provision.
Understand:	Comprehend the language, structure and intent behind a Code provision(s).
Apply:	Use the Code provision(s) in a case example, situation, or scenario.

Taking this course will not qualify you for 'Advanced Standing'. Refer to the Ministry website above for details.

LEARNING OUTCOMES

The course has been designed to introduce or increase (where applicable) a practitioner's knowledge of the Code and to hone skills in terms of their ability to **FIND** (search the Code and identify Code provisions), **UNDERSTAND** (to comprehend the language, structure and intent of a Code provision), and **APPLY** the Code provision(s) using case examples, situations and scenarios.

The Ministry of Municipal Affairs also provides more comprehensive courses for practitioners wishing to obtain more detailed training in the use and application of the Code and a number of its referenced standards.

For information on the available courses, refer to the following website:

http://ontario.ca/buildingcode

under the heading "Training".

COURSE FORMAT

This course is organized in nineteen modules and is intended for those who desire to become more proficient in applying the provisions of the requirements applicable to Large Buildings.

PURPOSE OF THE EXERCISES

Every module contains a number of exercises. Each exercise is designed to help you to identify, understand and apply the requirements of the Code and their effect on the design and construction of large buildings. The exercises are fill-in-the-blanks. You will also be asked to complete charts and tables which can later be used as reference material.

You will also be required to indicate the Code reference for your answer. Pay attention to the detail of the reference.

Any time a Code reference is asked for, it will be identified by brackets [. . .].

As you go along, you are encouraged to modify and enhance your copy of the Code.

When reference is made to specific parts of the Building Code at the beginning of an exercise, you may find it useful to review those references **before** attempting the exercise.

COURSE RESOURCES

Your participation, with support from the Facilitator, the Code, and the experiences, ideas, and comments of your fellow students are the primary resources of this course. The objective of the course integrates your education, prior training and on-the-job experience, as well as those of your peers. It is important that you participate. For each question or task that is assigned to your table-group, you will select a spokesperson who will print the agreed upon answer on the flipchart. When asked by the Facilitator, the spokesperson will explain the group's answer, which form the basis for class discussion.

The course requires the latest edition of the following documents:

1. 2006 Building Code Compendium, Volume 1and Volume 2

The above documents are available for purchase through:

Publications Ontario
777 Bay St., Market Level
Toronto, ON M5G 2C8

Tel: 1-800-668-9938, 416-326-5300
Fax: 416-325-3407

https://www.publications.gov.on.ca

Service Ontario
110 Laurier Ave. West
Ottawa, ON K1P 1J1

COURSE OVERVIEW

As stated earlier, the course is organized into nineteen modules. The modules are described as follows:

Module 1	Introduction and Instructions Administrative Requirements
Module 2	Fire Protection Occupant Safety Accessibility Occupancy, Construction Types, Fire-resistance, Occupant Loads
Module 3	Supplementary Standard SB-2 Fire Performance Ratings
Module 4	Building Fire Safety - Part 1 (Subsections 3.2.1., 3.2.2.)
Module 5	Building Fire Safety - Part 2 (Subsection 3.2.3.)
Module 6	Building Fire Safety – Part 3 (Subsections 3.2.4., 3.2.5., 3.2.7., 3.2.8.1., 3.2.8.2., and 3.2.9.)
Module 7	Safety Within Floor Areas (Section 3.3)
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Module 17	Part 5 Environmental Separation
Module 18	Structural Design, HVAC, Plumbing, Housing and Small Buildings, and Resource Conservation
Module 19	Sample Exam Questions

A GUIDE TO THE USE OF THE BUILDING CODE

The Building Code is a regulation made under the Building Code Act. This edition is prepared for purposes of convenience only and contains additional explanatory material. For accurate reference, recourse should be had to the Official Volumes.

The Building Code is based, in large measure, on the National Building Code of Canada (NBC).

The Code is essentially a set of minimum provisions respecting the safety of buildings with reference to public health, fire protection and structural sufficiency. It is not intended to be a textbook on building design, advice on which should be sought from professional sources. Its primary purpose is the promotion of public safety through the application of appropriate uniform building standards.

The 2006 edition of the Building Code is the first to be published in an objective-based format. The Building Code is divided into three divisions which is further subdivided into parts: Division A, Compliance, Objectives and Functional Statements; Division B, Acceptable Solutions; Division C, Administrative Provisions. In addition, the Code provides two sets of Appendices; Appendix A contains explanatory information to assist Code users in understanding the intent of requirements contained in Divisions A, B and C. Appendix B contains Imperial conversion factors for metric values used in the Code and lastly, Supplementary Standards which supersede former Supplementary Guidelines referenced in the 1997 edition of the Code. Supplementary Standards with the SA prefix are referenced in Division A, Supplementary Standards with the SB prefix are referenced in Division B, and Supplementary Standards with the SC prefix are referenced in Division C.

DIVISION A, PART 1 – COMPLIANCE/GENERAL SECTION 1.1 ORGANIZATION AND APPLICATION

The organization and application of the Code is located in Division A, Part 1, Section 1.1. This section provides a description of the scopes of each of the divisions of the Code and statements regarding the applications of the various parts of Division B of the Code. Division B contains all of the acceptable solutions for compliance with requirements of the Code. Division B replaces the previous 12 parts of the 1997 Code. Division B is now broken down into 11 parts, and a section on existing buildings [Div. A, 1.1.2.7.]. The Large Building Course only covers requirements contained in Parts 1, 3, 4, 5, 6, 7, 11, 12 and existing buildings.

Division B is divided into 12 Parts and a decimal numbering system has been used to identify particular requirements. The first number indicates the Part of the Code, the second, the Section in the Part, the third, the Subsection and the fourth, the Article in the Subsection. An Article may be further broken down into Sentences (indicated by numbers in brackets), and the Sentence further divided into Clauses and Subclauses. These are illustrated as follows:

3	Part
3.4.	Section
3.4.6.	Subsection
3.4.6.5.	Article
3.4.6.5.(1)	Sentence
3.4.6.5.(1)(c)	Clause
3.4.6.5.(1)(c)(i)	Subclause

SECTION 1.2, COMPLIANCE

Compliance with Division B of the Code may now be achieved by:

a) complying with the applicable, acceptable solutions in Division B, OR
b) by using alternative solutions that will achieve the level of performance required by the applicable, acceptable

solutions in respect to the objectives and functional statements attributed to the applicable, acceptable solutions in Supplementary Standard SA-1for the purpose of determining using an alternative solution. The level of performance in respect to the functional statement refers to the performance of the functional statement as it relates to the objective with which it is associated in SA-1.

SECTION 1.3, INTERPRETATION

Section 1.3 contains interpretation requirements related to designated structures and farm buildings.

SECTION 1.4, TERMS AND ABBREVIATIONS

Section 1.4, Terms and Abbreviations are described in the Div. A, Article 1.4.1.

Only defined terms in the Large Building exam syllabus are included in the Large Building course exam.

SECTION 1.5, REFERENCED DOCUMENTS AND ORGANIZATIONS

Provisions of referenced documents in Divisions A and B apply only to:

a) buildings, and
b) objectives and functional statements attributed to the acceptable solutions in Division B.

Document editions and abbreviations are found in Division B, Section 1.3.

BASIC RULES FROM THE CODE

DEFINED WORDS, TERMS AND PHRASES

Words, terms and phrases with special meaning are defined in Division A, Part 1, Sentence 1.4.1.2.(1) of the Code.

The definition always applies unless the word, term or phrase has a special purpose definition listed elsewhere.

For consistency with the Code, defined terms are shown in *italics*. The definition for each defined term used in a module is repeated at the beginning of each module.

NON-DEFINED WORDS, TERMS AND PHRASES

Consult Division A, Part 1, Sentence 1.4.1.1.(1) of the Code. It provides direction for dealing with non-defined terms. Note any question, comment or concern in the space provided.

____

____

____

ABBREVIATIONS AND SYMBOLS

The Code makes use of symbols and abbreviated nouns, terms and proper names. For example, Div. B, Clause 3.2.6.9.(3)(a) makes reference to CAN4 being an abbreviated name of Underwriters' Laboratories of Canada. Division B, Part 1, Article 1.3.2.1. of the Code will reveal a number of abbreviations for proper names, along with contact information.

The meanings assigned to other 'Symbols and Abbreviations' used in the Code are found in Division A, Part 1, Sentence 1.4.2.1.(1). As examples, the letter 'h' means 'hour' in Div. B, Clause 3.2.2.23.(2)(c) and 'hours' in Div. B, Clause 3.2.2.23.(2)(b); the expression '1 in 2' means a slope of 1 vertical unit to 2 horizontal units.

BASIC RULES FOR READING THE CODE - SCOPE AND APPLICATION OF CODE REQUIREMENTS

Individual requirements within the Code do not apply to every building. Guidance in the application of each of the 12 Parts of Division B of the Code to a particular building is found in Division A, Part 1, Subsection 1.1.2., "Application of Division B".

For instance, Division A, Part 1, Sentence 1.1.2.1.(1) informs us that Parts 1, 7 and 12 apply to every building. On the other hand, Division A, Part 1, Sentence 1.1.2.4.(1) reveals that Part 9 would apply to buildings of residential, business, low and medium hazard industrial, and mercantile occupancies of three storeys or less in building height and having a building area not exceeding 600 m^2.

In another instance, Division A, Part 1, Subclauses 1.1.2.2.(1)(b)(i) to (iv) indicate that a building of residential, business, low and medium hazard industrial or mercantile occupancy would be governed by Part 3, instead of Part 9, if the building area exceeded 600 m^2 or the building height exceeded 3 storeys.

It becomes very clear that one does not jump from Part 9 to Part 3, or from Part 3 to Part 9, unless the Code provides direction to that effect. Consider Division B, Articles 3.1.7.1. and 9.10.3.1. as one example and Articles 3.1.8.10. and 9.10.13.2. as a second example.

In the first instance, Division B, Sentence 9.10.3.1.(1) informs us that a fire-resistance rating can be determined in conformance with the test methods described in Part 3, thus in this instance, the requirements of Article 3.1.7.1. may be applied to a building regulated by Part 9.

In the second instance, Sentence 3.1.8.10.(4) informs us that in schools a door assembly conforming to Articles 9.10.13.2. and 9.10.13.3. is permitted as a closure in a fire separation having a fire-resistance rating of 30 minutes. Thus in this instance, a provision of Part 9 is deemed to form part of a Part 3 requirement.

DEALING WITH 'AND'

The word **'and'** found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirements of **every** Clause apply to the Sentence.

Example:

Division B, Sentence 3.2.8.7.(2) reads:

In a building containing an interconnected floor space

a) waterflow alarm signals from sprinkler systems shall be transmitted to the fire department in conformance with Sentence 3.2.4.7.(4), and
b) sprinkler systems shall be electrically supervised as required in Sentence 3.2.4.9.(2).

Sentence 3.2.8.7.(2) informs us that in a building containing an interconnected floor space, the sprinkler systems shall have two things:

1. water flow alarm signals shall be transmitted to the fire department, AND
2. be electrically supervised.

DEALING WITH 'OR'

The word **'or'** found at the end of the second last Clause of a Sentence with multiple Clauses means that the requirement of the Sentence is satisfied by any Clause as applied individually.

Example:

Division B, Sentence 3.2.9.4.(7) reads:

A hose is permitted to penetrate an exit in order to provide the required coverage to
a) a service room referred to in Sentence 3.2.9.1.(4),
b) a roof-top enclosure referred to in Sentence 3.2.9.1.(5),
c) a room not more than 50 m^2 in area, or
d) a room or group of rooms in a sprinklered floor area not more than 200 m^2.

Sentence 3.2.9.4.(7) informs us that a fire hose is permitted to penetrate an exit in order to provide the required coverage to any one of four areas:

1. a service room, OR
2. a rooftop enclosure, OR
3. a room less than 50 m^2 in area, OR
4. a sprinklered room or group of rooms less than 200 m^2 in area.

DEALING WITH 'AND'/ 'OR'

Example:

Division B, Sentence 3.2.6.1(1) reads:

This Subsection applies to a building

a) of Group A, D, E or F major occupancy classification that is more than

   i) 36 m high, measured between grade and the floor level of the top storey, or
   ii) 18 m high, measured between grade and the floor level of the top storey, and in which the cumulative or total occupant load on or above any storey above grade, other than the first storey, divided by 1.8 times the width in metres of all exit stairs at that storey, exceeds 300,

b) containing a Group B major occupancy in which the floor level of the highest storey of that major occupancy is more than 18 m above grade,

c) containing a floor area or part of a floor area located above the third storey designed or intended as a Group B, Division 2 or 3 occupancy, and

d) containing a Group C major occupancy whose floor level is more than 18 m above grade.

Sentence 3.2.6.1.(1) informs us that the additional requirements for High Buildings found in 3.2.6. apply to:

1. Group A, D, E or F classified buildings (major occupancy) more than 36 m high, OR

   Group A, D, E, or F classified buildings (major occupancy) more than 18 m high if the total occupant load above the first storey , divided by 1.8 times the width of all exit stairs at the storey above the first, exceeds 300, AND

2. Buildings containing a Group B major occupancy more than 18 m high, AND

3. Buildings containing a floor area or part of a floor area above the third storey intended as a Group B, Division 2 OR 3 occupancy, AND

4. Buildings containing a Group C major occupancy whose floor level is more than 18 m above grade.

RULES OF THE CODE

The Code is structured into a number of Rules that apply without exception. For example, Division B, Sentence 9.1.1.3.(1) tells us that self-service storage buildings (even those with a building area of less than 600 m^2) are regulated by Section 3.10.

GENERAL RULES OF THE CODE AND EXCEPTIONS

At other times, the user of the Code has to consider a general rule and exceptions as they apply. Consider the requirements for automatic sprinkler systems in Division B, Sentence 3.2.5.13.(1):

> Except as provided in Sentences (2) to (4), an automatic sprinkler system shall be designed, constructed, installed and tested in conformance with NFPA 13, "Standard for the Installation of Sprinkler Systems".

The general rule of Sentence 3.2.5.13.(1) informs us that sprinkler systems are to be designed, constructed, installed and tested in conformance with NFPA 13.

OR

There are three exceptions to the general rule of Sentence 3.2.5.13.(1). The first exception in Sentence 3.2.5.13.(2) states:

> Instead of requirements of Sentence (1), NFPA 13R, "Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Storeys in Height", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that is not more than 4 storeys in building height or a Group B, Division 3 occupancy that contains sleeping accommodation for not more than 10 persons, and not more than 6 persons that required assistance in case of emergency.

The second exception in Sentence 3.2.5.13.(3) states:

> Instead of the requirements of Sentence (1), NFPA 13D, "Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes", is permitted to be used for the design, construction, installation and testing of an automatic sprinkler system installed in a building of residential occupancy that contains not more than 2 dwelling units.

The third exception in Sentence 3.2.5.13.(4) states:

> If a building contains fewer than 9 sprinklers, the water supply for these sprinklers is permitted to be supplied from the domestic water system for the building provided the required flow for the sprinklers can be met by the domestic system.

VERY IMPORTANT

When the Code spells out a general rule and exceptions thereto, conformity with the Code is obtained by complying with EITHER the general rule OR the exception thereto.

TABLES, TEXT AND FOOTNOTES

Whenever you are called upon to use a Table, you have to **consider the text** associated with **the Table** AND **the footnotes**. For example, Division B, Table 3.1.3.1 forms part of Sentence 3.1.3.1.(1). One of the Notes to Table 3.1.3.1., Note (2) directs us to Sentence 3.1.3.2.(1), which tells us that any building with any Group A, B or C occupancy, cannot contain a major occupancy of Group F, Division 1.

SUPPLEMENTARY STANDARDS AND REFERENCED DOCUMENTS

By virtue of Paragraph 34.-(1) 9 of the Building Code Act, the "Supplementary Standards to the 2006 Building Code", SA-1, SB-1 to SB-11 and SC-1, and the Referenced Documents listed in Division B, Part 1, Section 1.3 of the Code form an integral part of the Building Code.

APPENDICES AND ILLUSTRATED GUIDES

On the other hand, Appendix A "Explanatory Material for Division B", Appendix B "Imperial Conversions of Metric Values" have been prepared for convenience only, and as such, are explanations that do not form part of the Building Code and are not intended to limit the ways by which compliance with Code requirements can be achieved.

DIVISION A, PART 2 - OBJECTIVES

Objectives for all the requirements in the Code are broken down into the following categories and subcategories. Category "Safety" identified by the prefix OS, "Fire Safety" identified by the prefix OS1, "Structural Safety" identified by the prefix OS2, "Safety in Use" identified by the prefix OS3 and "Resistance to Unwanted Entry" identified by the prefix OS4. "Health Objectives" is identified by the prefix OH, with the following sub-prefixes "Indoor Conditions" – OH1, "Sanitation" – OH2, "Noise Protection" – OH3, "Vibration and Deflection Limitation" – OH4, "Hazardous Substances Containment" – OH5, "Privacy" – OH6, and "View to the Outdoors" – OH7. Accessibility category OA is further subdivided into the following subcategories: "Barrier-free Path of Travel" – OA1, "Barrier-free Facilities" – OA2, "Fire Structural Water and Sewage Protection of Buildings" is identified by the prefix OP with subcategories: "Fire Protection of the Building" – OP1, "Structural Sufficiency of the Building" – OP2, "Protection of Adjacent Buildings from Fire" – OP3, "Protection of Adjacent Buildings from Structural Damage" – OP4, "Water and Sewage Protection of Buildings and Facilities" – OP5. "Resource Conservation Objective" is identified by the prefix OR with subcategories: "Water Conservation" – OR1, and "Energy Conservation" – OR2. "Environmental Integrity" is identified by the prefix OE. "Conservation of Buildings" is identified by the prefix OC.

DIVISION A, PART 3 - FUNCTIONAL STATEMENTS

The list of functional statements applies only to the extent that they relate to compliance with the Code as described in Division A, Section 1.2, Compliance. Functional statements are a list of statements which describe the intent of the Code requirements described in Division B as they relate to one or more of the objective statements previously identified.

OBJECTIVES AND FUNCTIONAL STATEMENTS ATTRIBUTED TO THE ACCEPTABLE SOLUTIONS IN DIVISION B

For the purposes of complying with the Code, as required by Division A, Sentence 1.2.1.1.(2), the objectives and functional statements attributed to the acceptable solutions in Division B are listed in Tables 3 to 12 of Supplementary Standard SA-1.

Table 3 relates to Division B, Part 3 requirements; Table 4 relates to Division B, Part 4 requirements, etc.

ADMINISTRATIVE DIVISIONS

DIVISION C, PART 1

Section 1.1 Administration, Article 1.1.1.1. indicates that the Code shall be administered in conformance with the Building Code Act. Section 1.2 Design and General Review, only Article 1.2.2.1. is covered under the exam syllabus for Large Buildings which provides requirements for general review by an architect or a professional engineer. Section 1.3 Permits and Inspections, only the following requirements for permits are covered by the Large Building exam syllabus. Article 1.3.1.1. Requirements for Permits, Sentence 1.3.1.4.(1) Permits under Section 10 of the Act and Sentence 1.3.1.5.(1) Conditional Permits. All of Subsection 1.3.2., Site Documents is covered under the exam syllabus. Subsection 1.3.3., Occupancy of Unfinished Buildings, should be reviewed by Large Building course participants. In the Subsection 1.3.5., Notices and Inspections, only Clauses 1.3.5.1.(2)(f) and 1.3.5.1.(2)(n) dealing with substantial completion of all required fire separations and closures, and completion of construction and installation of components required to permit the issue of an occupancy permit, are required to be reviewed by Large Building course participants. The entire Subsection 1.3.6., As-Constructed Plans, requires review by Large Building course participants.

Areas of study should be coordinated with consultation with the published examination syllabus for this qualification.

DIVISION C, PART 2
ALTERNATIVE SOLUTIONS, DISPUTES, RULINGS AND INTERPRETATIONS

Section 2.1 entitled "Alternative Solutions" indicates in Subsection 2.1.1., the documentation for alternative solutions required to be provided to the chief building official or registered code agency. The documentation provided must identify the applicable objectives, functional statements and acceptable solutions and establish on the basis of either past performance, tests or other evaluations, that the proposed alternative solution will achieve the level of performance required under Article 1.2.1.1. of Division A, which is the compliance Article for compliance with Division B previously described. The documentation required for an alternative solution must include information about relative assumptions, limiting or restricting factors, testing procedures, studies or building performance parameters, including any commissioning, operational and maintenance requirements.

According to Article 2.1.1.2. Tests, where no published test or method to establish the suitability of an alternative solution exists, then tests used for the purposes of Article 2.1.1.1. shall be designed to simulate or exceed anticipated service conditions, or shall be designed to compare the performance of material or system or the similar material or system that is known to be acceptable. Results of tests evaluations based on test standards other than described in the Code may be used for the purposes of Sentence (1) of Article 2.1.1.2. if the alternate test standards provide comparable results. As an example, a test conducted in accordance with the Standard ASTM E119 for determining fire-resistance ratings may be used as a comparable test standard to that described in ULC-S101, "Fire Endurance Tests of Building Construction and Materials", as referenced in Division B, Article 3.1.7.1., Sentence (1), for most types of building materials and assemblies.

In Appendix A of the Large Building course is an example of an alternative solution submission including the documentation typically provided as described in Div. C, Article 2.1.1.1.

DIVISION C, PART 2, SECTION 2.4 – RULINGS AND INTERPRETATIONS

The following subsections are required to be understood by Large Building course participants, Subsection 2.4.1. Designated Materials Evaluation Bodies, Article 2.4.2.1. Ministers Rulings, and Subsection 2.4.3. Interpretations by the Minister under Section 28.1 of the Building Code Act.

CONFIRMATION OF LEARNING EXERCISE

At the end of this course, there are a number of multiple choice questions in a format similar to the questions found in the examination provided by the Ministry of Municipal Affairs, Building and Development Branch.

If time permits, we will take up these questions, however, if not, answers will be provided.

It should not be assumed that if you can answer these questions, you will be fully prepared for the Ministry exam. These are samples only.

Additional sample questions may be found on the MMAH/Buildings Branch website at:

http://ontario.ca/buildingcode

EXERCISE #1-1

1. Provide the objectives and functional statements attributed to the following (acronyms only required):

   a) 3.3.1.20.(1) ________________[______________]

   b) 3.8.3.3.(3) ________________[______________]

   c) 4.1.5.15.(3) ________________[______________]

   d) 6.3.1.2.(2) ________________[______________]

2. What is objective OS1.3? What category?

   ___________________________[________________]

3. What is functional statement F12?

   ___________________________[________________]

STOP

CLOSING COMMENTS

During the delivery of the course, you are asked to obey the STOP signs; the Facilitator will provide guidance to keep the course moving. Bring your questions and comments to the course and participate in all the discussions.

Your evaluation of the course and comments on its contents will be collected during the final session. Your input is important; it enables the Building and Development Branch of the Ministry of Municipal Affairs to keep the course current and to meet your needs. In preparation, you are asked to note your comments on plain paper as we proceed through the training modules. They will be collected at the end of the course. You will also be asked to evaluate the Facilitator and the facilities where the course is being held,
at the end of the course.

Unlike the course, for the qualification examination, you will not be asked to provide references to support your answers. Nevertheless, you are strongly encouraged to find the supporting part in the Code. Remember, you need to find a requirement before you can understand and apply it.

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 2

LARGE BUILDINGS - 2006

OCCUPANCY, CONSTRUCTION TYPES, FIRE-RESISTANCE, OCCUPANT LOAD

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

2.1 INTRODUCTION

Some requirements of the Building Code are dependent on the 'major occupancy' of that building. 'Occupancy' is defined in Division A, Article 1.4.1.2. as ". . . the use or intended use of a building or part thereof for the shelter or support of persons, animals or property."

The word occupancy should not be confused with the term 'major occupancy' which is defined as " . . . the principal occupancy for which a building or part thereof is used or intended to be used, and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy".

In this module we will examine the provisions of the Code that apply to the classification of buildings and requirements pertaining to the separation of major occupancies. We will examine the differences between buildings permitted to be of 'combustible construction' and those required to be of 'noncombustible construction'. We will study the methods used for determining 'fire-resistance ratings' of materials and assemblies, 'fire protection ratings' of closures, firestopping, surface burning characteristics of building materials and how the Code calculates the 'occupant load' of a building occupancy.

Objectives

Upon completion of this module, you will be able to:

- provide an understanding of the different major occupancies outlined in the Code by the alphanumerical method
- identify the required fire-resistance rating for fire separations between major occupancies

- identify the types of combustible materials that can be used in a building required to be of noncombustible construction
- determine the nature of fire separations and understand the concept of fire-resistance rating
- understand and apply the provisions of the Code relating to closures and components of closures
- determine when firestopping of building services and concealed spaces is required and the requirements they must meet
- provide an understanding of the requirements of the Code relating to flame spread ratings of materials
- outline the implications of occupant load and to be able to calculate occupant load
- reference applicable standards.

2.1 OVERVIEW (Section 3.1)

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. Defined terms will not be shown in italics in this module, other than in this section.

Building area
Building area means the greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centre line of firewalls.

Closure
Closure means a device or assembly for closing an opening through a fire separation or an exterior wall, such as a door, a shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors.

Combustible
Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Noncombustibility in Building Materials".

Combustible construction
Combustible construction means that type of construction that does not meet the requirements for noncombustible construction.

Fire compartment
Fire compartment means an enclosed space in a building that is separated from all other parts of the building by enclosing construction providing a fire separation that may be required to have a fire-resistance rating.

Fire damper

Fire damper means a closure which consists of a normally held open damper installed in an air distribution system or in a wall or floor assembly, and designed to close automatically in the event of a fire in order to maintain the integrity of the fire separation.

Fire-protection rating

Fire-protection rating means the time in minutes or hours that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in this Code.

Fire-resistance rating

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test as prescribed in this Code.

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Firewall

Firewall means a type of fire separation of noncombustible construction which subdivides a building or separates adjoining buildings to resist the spread of fire and which has a fire-resistance rating as prescribed in this Code and has structural stability to remain intact under fire conditions for the required fire-rated time.

Flame spread rating

Flame spread rating means an index or classification indicating the extent of spread-of-flame on the surface of the material or assembly of materials as determined in a standard fire test as prescribed in this Code.

Floor area

Floor area means the space on any storey of a building between exterior walls and required firewalls including the space occupied by interior walls and partitions, but not including exits, vertical service spaces, and their enclosing assemblies.

Major occupancy

Major occupancy means the principal occupancy for which a building or part of a building is used or intended to be used and is deemed to include the subsidiary occupancies that are an integral part of the principal occupancy.

Noncombustible

Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Noncombustibility in Building Materials".

Noncombustible construction

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Occupancy

Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Occupant load

Occupant load means the number of persons for which a building or part of a building is designed.

Partition

Partition means an interior wall one storey or part storey in height that is not loadbearing.

STOP

Building Classification (3.1.2.)

The following definitions are taken from Division A, Article 1.4.1.2. of the Code, for the following occupancies:

- Assembly occupancy (A1, A2, A3 and A4): the occupancy or use of a building or part of a building by a gathering of persons for civic, political, travel, religious, social, education, recreational or similar purposes or for the consumption of food or drink.

- Care or Detention occupancy (B1, B2 and B3): the occupancy or use of a building or part of a building by persons who:

  a) are dependent on others to release security devices to permit egress,
  b) receive special care and treatment, or
  c) receive supervisory care.

- Residential occupancy (C): the occupancy or use of a building or part of a building by persons for whom sleeping accommodation is provided but who are not harboured or detained there to receive medical care or treatment or who are not involuntarily detained there.

- Business and personal service occupancy (D): the occupancy or use of a building or part of a building for the transaction of business or the provision of professional or personal services.

- Mercantile occupancy (E): the occupancy or use of a building or part of a building for the displaying or selling of retail goods, wares or merchandise.

- Industrial occupancy (F1, F2 and F3): the occupancy or use of a building or part of a building for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Table 3.1.2.1 shows that some groups are broken down into divisions, for a more precise description of major occupancies.

You may have noticed, from the definition provided in the introduction to this module, that having a 'major occupancy' does not prevent subsidiary occupancies in the building.

The dividing line between a major occupancy and a subsidiary occupancy is not always clear-cut. Judgement and a clear understanding of concepts and terminology must be used to arrive at the appropriate classification.

A school would be classified as a Group A, Division 2 major occupancy. In addition to classrooms, the building could contain offices, laboratories, gymnasia and workshops that could be considered subsidiary occupancies. Nevertheless, the major occupancy of the building would be Group A, Division 2. This classification would apply wherever the requirements for major occupancy were specified.

Affect of Appendices

Table 3.1.2.1 provides a description of major occupancies, but no examples are listed. While there are examples provided in Appendix A, the appendices are not part of the Code; they merely contain explanatory information to assist Code users in understanding the text of the Code.

STOP

Separation of Major Occupancies: Fire Separations (3.1.3.1.)

Many buildings contain combinations of major occupancies that may represent a hazard to one another due to increased risk of exposure to fire. As a result, the Code requires that certain major occupancies be isolated from one another by fire separations, to protect one from the danger created by the other.

Based on the combination of major occupancies in a building, the designer must determine that appropriate fire separations are provided between adjoining major occupancies. Such fire separations are required to protect one major occupancy from another as they represent a hazard to each other. Adjoining means above, below or beside one another. Therefore, the plane of the fire separation could be either vertical or horizontal.

The required fire-resistance rating of a fire separation between adjoining major occupancies is determined from Table 3.1.3.1.

As we progress through this course, you will realize that the Code requires fire separations at numerous locations throughout a building. Fire separations are intended to slow or prevent the spread of fire and its smoke from where it begins in the building to another part, by applying the principle of compartmentation.

EXERCISE #2-1

Examine Figure 2-1. Take about 15 minutes to determine the major occupancy classification and the minimum fire-resistance rating for the fire separations between the adjoining major occupancies. Write your answers on the Drawings. Are your determinations the same as those of the rest of the group?

You will observe that some combinations do not represent a hazard to each other. Consequently, the Table does not call for a fire separation. For this exercise, we are not concerned with other types of fire separations. Have group discussions as required. Class discussions will begin in about 15 minutes.

Notes: ____

____

____

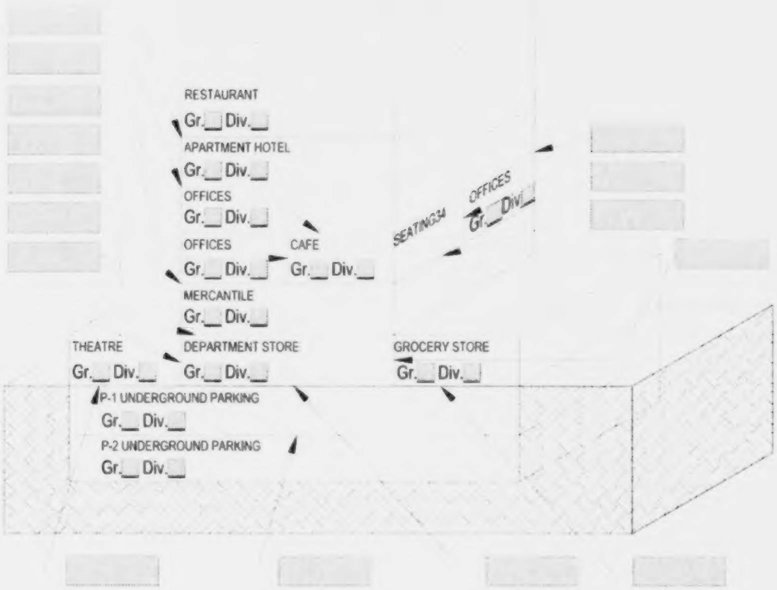
____

____

STOP

Table 2-1 can be used as a reference for determining the minimum required fire-resistance rating for a fire separation between adjoining major occupancies.

Minimum Fire-Resistance Rating of Fire Separations Between Adjoining Major Occupancies



Schematic of uses for a multi-storey building not regulated by Subsection 3.2.6. Indicate FRRs (in hours) beside arrows.

RESTAURANT
Gr.__ Div.__
APARTMENT HOTEL
Gr.__ Div.__
OFFICES
Gr.__ Div.__
OFFICES
Gr.__ Div.__
CAFE
Gr.__ Div.__
SEATING34
OFFICES
Gr.__ Div.__
MERCANTILE
Gr.__ Div.__
THEATRE
Gr.__ Div.__
DEPARTMENT STORE
Gr.__ Div.__
GROCERY STORE
Gr.__ Div.__
P-1 UNDERGROUND PARKING
Gr.__ Div.__
P-2 UNDERGROUND PARKING
Gr.__ Div.__

FIGURE 2-1

TABLE 2-1

Minimum Fire-Resistance Ratings
Between Major Occupancies

Major Occupancy	Adjoining Major Occupancy	Minimum Fire-Resistance Rating of Fire Separation
A1	E	2 h
A1	F3	1 h
A2	C	1 h
B2	B3	1 h
B3	C	2 h
C	D	1 h
C	E	2 h plus 3.1.3.1.(2)
D	C	1 h
D	E	not required
E	A1	2 h plus 3.1.3.2.(1)
E	A2	2 h plus 3.1.3.2.(1)
E	F1	3 h
E	F3	not required

Note: Not all major occupancy combinations are shown.

Noncombustible Construction (3.1.5.)

Buildings are classified in accordance with Subsection 3.2.2. in order to prevent fire spread and collapse caused by the effects of fire. The requirement to have the building constructed of noncombustible materials is determined from this Subsection. The principal factors involved in classification are building height, building area and occupancy. The occupancy of the building has a direct relationship with the probable fire loads that can be expected, under normal use, in the building. The building height and building area are measures used to determine the building exiting and firefighting potential.

Noncombustible construction means that, except for combustible items specifically permitted, all components of the building regulated by the Code must be of noncombustible construction. Many of the finish materials and other items not directly involved in the load carrying system may be of combustible materials if specifically listed in Subsection 3.1.5.

Construction Types

There are two principal types of construction: combustible and noncombustible. Combustible construction has little inherent fire-resistance rating unless it is protected or of heavy timber. Even noncombustible construction requires protection to prevent its collapse when exposed to fire because structural steel or reinforcing steel has its load carrying capacity reduced at elevated temperatures. The primary difference between combustible and noncombustible construction is that noncombustible materials do not burn and contribute fuel to a fire.

This part of the Module will focus on Part 3 buildings that are required to be constructed of noncombustible construction.

Combustible versus Noncombustible Construction

Division A, Article 1.4.1.2. of the Code states that combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Noncombustibility in Building Materials". In brief, the combustible material may experience a loss of mass, or the material may cause a significant increase in temperature when subjected to this test.

In turn, combustible construction means " . . . that type of construction that does not conform to the requirements for noncombustible construction".

Combustible construction represents a greater potential for total fire involvement than noncombustible construction. As a result:

- Combustible materials usually have a higher flame spread rating, which reflect their capacity to support the spread of fire unless they are covered with materials having a better fire performance rating.
- Combustible materials increase the fire load, thereby increasing the potential for a larger and more severe fire.

Because of the higher risk of fire in combustible, as compared to noncombustible materials, the Code limits the use of combustible construction to smaller buildings in terms of height and area, in which fires can be more easily controlled by firefighters, and occupancies which provide lower risk.

Generally speaking, when a building is permitted to be of combustible construction, it is permitted to be constructed of the combustible materials described in Part 9, with or without noncombustible components.

If a building required to be of noncombustible construction contains combustible components not specifically permitted by Subsection 3.1.5., the building falls within the category of combustible construction.

When a building is required to be of noncombustible construction, the materials, assembly of materials, and structural members are required to be noncombustible or notwithstanding the definition for noncombustible materials, other materials are permitted provided that when tested in accordance with the Standard CAN/ULC-S135, at a heat flux of 50 kW/m^2,

a) have an average total heat release $\leq$ 3MJ/m^2,
b) have an average total smoke extinction area not more than 1.0 m^2, and
c) show no further release of heat or smoke when the test is extended beyond the time stipulated in the test Standard [Sentence 3.1.5.1.(2)].

Combustible materials are permitted by Articles 3.1.5.2. to 3.1.5.26., 3.1.13.4. (Light Diffusers and Lenses), and 3.2.2.16. (the authority to allow heavy timber roofs).

STOP

Review Table 2-2. This provides examples of commonly encountered building materials, and whether they are typically classed as combustible or noncombustible materials.

This type of information can be found in MSDS sheets, listing directories such as from ULC or in Supplementary Standard SB-2.

TABLE 2-2

Material	Combustible/Noncombustible
Vinyl faced gypsum wallboard	combustible
Paper faced gypsum wallboard	combustible
Polypropylene drain waste & vent pipe	combustible
Electrical wire (14-2 romex)	combustible
Vermiculite insulation	combustible
Glass fibre insulation	combustible - resin and binders will affect test
Light gauge steel studs	noncombustible
Wood strip flooring	combustible
Wood frame partitions	combustible
Heavy timber construction	combustible
Vinyl window sashes and frames	combustible
Silicone caulking	combustible
Tar and gravel roof	combustible
ABS or PVC drain waste & vent pipe	combustible
Plaster (portland cement and sand)	noncombustible
Fire retardant plywood	combustible
Gypsum wallboard Type X	combustible
Styrofoam insulation	combustible
Aluminum	Combustible/noncombustible - pure aluminum is not used in construction. It is mixed with other metals to form alloys, to be confirmed by test or interpretation of previous tests (e.g. since tested aluminum with 2% copper and 6% copper both passed, then it would be safe to say that aluminum with a 4% copper content is okay.
Flame-resistant fabrics	combustible

Permitted Combustibles

For obvious reasons, e.g. paper covering on gypsum wallboard (Article 3.1.5.11.), a building cannot be made from 100% noncombustible materials and products. Articles 3.1.5.2. to 3.1.5.26. contain most of the exceptions that permit combustible components in a building or part of a building required to be of noncombustible construction. As you work with the exceptions, you will realize that individual exceptions have their own limitations and conditions.

Section 3.1.5. is not the only location in the Code with requirements related to permitted combustibles. Other requirements are found in Part 6 (HVAC), and Part 9, with links to Part 3. For example, Article 6.2.3.2. provides requirements for air ducts, fittings and plenums that link to 3.1.5.14. (FSR and SDC) and 3.1.9. (firestopping)

In the next Table, you will see that a minor amount of combustibles, within set limits and conditions, is permitted to be used when noncombustible construction is required. However, if these limits and conditions are exceeded, then the construction is considered to be combustible construction.

TABLE 2-3

Combustible Material	Applicable Code Reference for Noncombustible Construction
Vinyl faced gypsum wallboard	3.1.5.10.(1)
Paper faced gypsum wallboard	3.1.5.11.
Polypropylene drain waste and vent pipe	3.1.5.16.(3)
Electrical wire (14-2 romex)	3.1.5.18.
Vermiculite insulation	3.1.5.12.
Glass fibre insulation	3.1.5.12.
Wood strip flooring	3.1.5.8.(3), (4)
Wood frame partitions	3.1.5.13.
Heavy timber construction	3.1.5.1.(1), 3.2.2.16.
Vinyl window sashes and frames	3.1.5.4.(5)
Silicone caulking	3.1.5.2.(1)(b)
Tar and gravel roof	3.1.5.3.(1)
ABS or PVC drain waste and vent pipe	3.1.5.16.(1)
Fire retardant plywood as wall finish	3.1.5.10.(2)
Gypsum wallboard Type X	3.1.5.11.
Styrofoam insulation	3.1.5.12.
Aluminum siding failing CAN4-S114 test	3.1.5.5.
Flame resistant fabric canopy	3.1.16.1.(1)

STOP

Combustible Insulation (3.1.5.12.)

Insulation is not an interior finish material. For combustible insulation materials and foamed plastic insulations, the standard flame-spread test does not provide a true measure of the relative hazard constituted by insulating materials in an actual fire. Foamed plastic insulation materials represent particular hazards: when exposed to fire, they produce dense smoke and release products of combustion that are both flammable and harmful.

Consequently, the Code requires most combustible insulation materials to be protected from adjacent spaces in the building by other, less hazardous building materials. The required protection is referred to as a thermal barrier.

The type or thermal barrier required to protect combustible and foamed plastic insulation is based on several factors, including the type of construction permitted.

The required protection applies to assemblies adjoining floor areas and exit systems where occupants have access. As well, although horizontal and vertical service spaces are not considered to have an occupant load, and in many cases are unoccupied except for occasional inspection or servicing, they nonetheless require treatment to minimize the risk associated with the spread of smoke and fire from insulation materials.

Protection of Combustible and Foamed Plastic Insulation in Buildings Required to be of Noncombustible Construction (3.1.5.12.)

Foamed plastic and combustible insulation materials are permitted to be used in buildings required to be of noncombustible construction. In most cases, the insulation is required to be protected from adjacent space in the building by a thermal barrier.

In buildings of noncombustible construction, the type of thermal barrier required is based on factors including:

- The type of insulation (combustible or foamed plastic)
- Its flame-spread rating
- Its location in the building (i.e. in an interior or exterior wall or ceiling assembly)
- The height of the building
- Whether the building is sprinklered
- Its major occupancy classification.

The location of the combustible insulation is the primary factor used to identify which Code rules determine the characteristics required of a thermal barrier.

The following Table 2-4 forms a useful reference table for all OBC requirements reflecting the need for a thermal barrier.

TABLE 2-4

Code	Description of Thermal Barrier	* Insulation Material Located in Building Conditions
Sentence 3.1.5.12.(2)	• 12.7 mm gypsum board or lath & plaster, mechanically fastened • Masonry or concrete • Classification B tested to CAN4-S124-M	Foamed plastic, FSR $\leq$ 25 in: • all locations in every building
Sentence 3.1.5.12.(3)	• 12.7 mm gypsum board with joints either backed or taped and filled or lath & plaster, mechanically fastened independent of insulation • 25 mm masonry or concrete • Any thermal barrier meeting the temperature criteria after 10 min exposure to fire (CAN/ULC-S101)	Combustible insulation including foamed plastic with FSR > 25 but $\leq$ 500 in exterior walls of: • unsprinklered buildings more than 18 m high • unsprinklered 3.2.6. buildings
Sentence 3.1.5.12.(4)	• 15.9 mm Type X gypsum board with joints backed or taped & filled, mechanically fastened independent of insulation • Nonloadbearing masonry/concrete $\geq$ 50 mm • Loadbearing masonry/concrete $\geq$ 75 mm • CAN/ULC-S101-M tested 40 minutes (20 minute temperature rise)	Combustible insulation including foamed plastic with FSR > 25 but $\leq$ 500 in interior walls of: • unsprinklered buildings more than 18 m high • unsprinklered buildings constructed under Subsection 3.2.6.
Sentence 3.1.5.12.(6)	• Factory assembled exterior wall panel, CAN/ULC-S101-M tested (10 minute remain in place steel skin)	Thermosetting foamed plastic insulation with FSR $\leq$ 500 in exterior wall panels of: • Any building not more than 18 m high without Group B or C major occupancy
Article 3.2.3.8.	• Masonry/concrete $\geq$ 25 mm • CAN/ULC-S101-M tested OR • Article 3.1.5.5. tested combustible cladding meeting CAN/ULC-S134	**STOP**

3.1.5.13. Combustible Elements in Partitions

3.1.5.14. Storage Lockers in Residential Buildings

3.1.5.15. Combustible Ducts

3.1.5.16. Combustible Piping Materials

3.1.5.17. Combustible Plumbing Fixtures

3.1.5.18. Wires and Cables

3.1.5.19. Combustible Travelling Cables for Elevators

3.1.5.20. Nonmetallic Raceways

3.1.5.21. Wires in Computer Room Floors

3.1.5.22. Combustible Components in Public Pools and Spas

3.1.5.23. Marquees Having Combustible Elements

3.1.5.24. Combustible Mezzanines

3.1.5.25. Wood Decorative Cladding

3.1.5.26. Combustible Solar Collective Systems

Fire Separations and Fire-Resistance Ratings (3.1.7.)

In this section, we will examine two concepts: fire separation and fire-resistance rating. Although the two terms have different meanings, they are related, and therefore will be dealt with together.

A fire separation is defined as a construction assembly that acts as a barrier against the spread of fire. A fire separation may or may not be required to have a fire-resistance rating.

A fire-resistance rating (FRR) measures the length of time a representative portion of an assembly is able to withstand the conditions of a standard test.

In this part of the module, we will not pursue where fire separations are required or how to determine FRR. (For example, the determination of fire-resistance rating by the listed or the generic method is not part of this module. This is covered in Module 3.)

The Nature of Fire Separations (3.1.8.)

The concept of fire separations is based on the principle of compartmentation. While Subsection 3.1.8. of the Code states the rules governing the construction of fire separations, other parts of the Code specify where they are required and whether or not they require a FRR.

Continuous horizontal and vertical fire separations are constructed in order to form fire compartments. Fire separations impede fire, smoke, heat, flames and products of combustion from spreading from one fire compartment to another.

General Requirements for Fire Separations (3.1.8.1.)

The fire separations that form a fire compartment have two major requirements:

- They must be continuous.
- May require a fire-resistance rating.
- Any opening in the fire separation must be protected.

Fire Separations and Fire-Resistance Ratings

Sometimes a fire separation does not require an FRR.

1. For Fire Separations Without an FRR

    - The fire separation is designed as a continuous element of the compartment.
    - Construction will hold back smoke, but is not evaluated to withstand the conditions of the standard fire test.

- The fire separations are built of materials that comply with the type of construction required for the building.
- Openings must still be protected.

While such materials could fail in flaming fire conditions, they would in the meantime prevent the passage of smoke to other parts of the building.

2. For Fire Separations Having an FRR

- The fire separation is designed as a continuous element of the compartment and built of materials that comply with the type of construction required for the building.
- Construction will hold back both fire and smoke for a length of time.
- Openings must be protected by closures such as fire doors, fire dampers, wired glass or glass block.
- Such closures are required to have a fire protection rating.

3. For Construction Requiring an FRR but Not Required to Act as a Fire Separation

- The assembly is built of materials that comply with the type of construction required for the building.
- Openings are not protected.
- The material, assembly of materials or structural member must possess a verifiable FRR.

1. Consider Figure 2-2. It illustrates the concepts of fire separations with and without a fire-resistance rating, and the concept of an assembly having an FRR without being a fire separation.

Figure 2-2 (A):

The floor assembly is a fire separation (FS) with FRR. The beam is part of an arch with a FRR not less than that of the supported assembly, but it is not a FS. That is why a fire damper is required at the duct through the floor, but not at the beam [Sentence 3.1.8.7.(1)]. The column has a FRR not less than that of the supported assemblies, but it does not act as a FS.

Figure 2-2 (B):

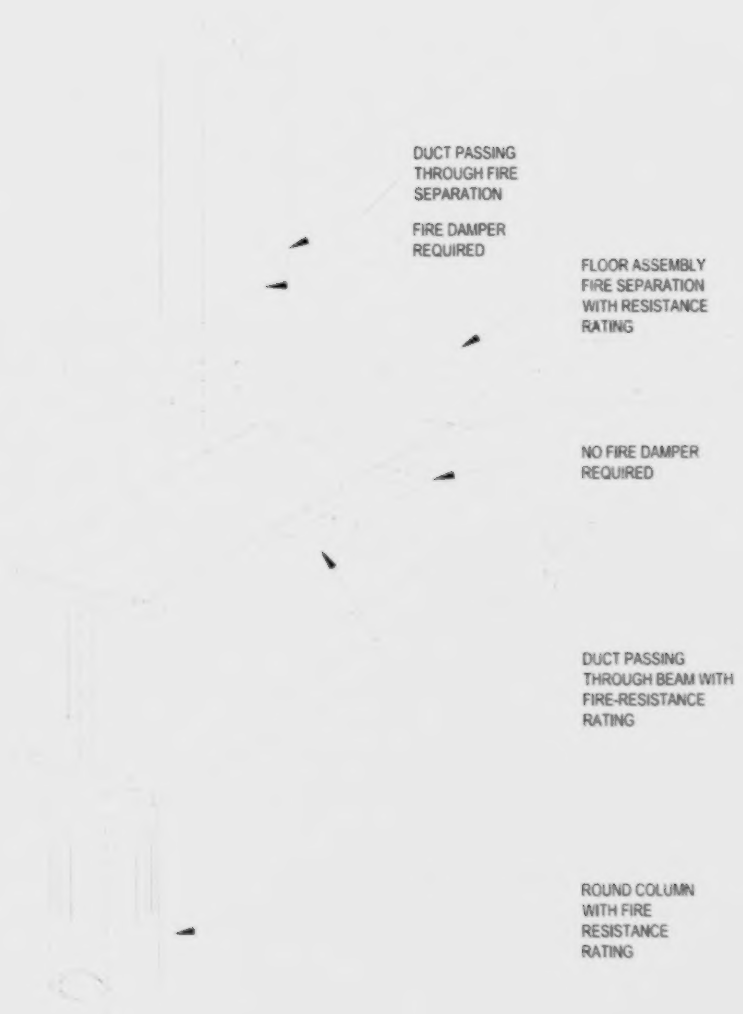
The floor assembly is a FS with FRR. The beam and wall form part of the FS, with a FRR not less than that of the supported assembly. A fire damper is required at the floor, beam and wall, for continuity of the FS [Sentence 3.1.8.7.(1)].

Figure 2-2 (C):

The floor assembly is a FS with FRR. The roof assembly, without occupancy, has a FRR but is not a FS. That is why a fire damper is required at the floor, but not at the roof.

Horizontal Service Spaces and Continuity of Vertical Fire Separations (3.1.8.3.)

The integrity of a vertical fire separation (VFS) that intersects with or abuts upon a horizontal service space (HSS) is regulated by Article 3.1.8.3.



Distinction Between Fire Separation and Fire-Resistance Rating (F.R.R.)

DUCT PASSING THROUGH FIRE SEPARATION
FIRE DAMPER REQUIRED
FLOOR ASSEMBLY FIRE SEPARATION WITH RESISTANCE RATING
NO FIRE DAMPER REQUIRED
DUCT PASSING THROUGH BEAM WITH FIRE-RESISTANCE RATING
ROUND COLUMN WITH FIRE RESISTANCE RATING

FIGURE 2-2 (A)

Distinction Between Fire Separation and Fire-Resistance Rating (F.R.R.)

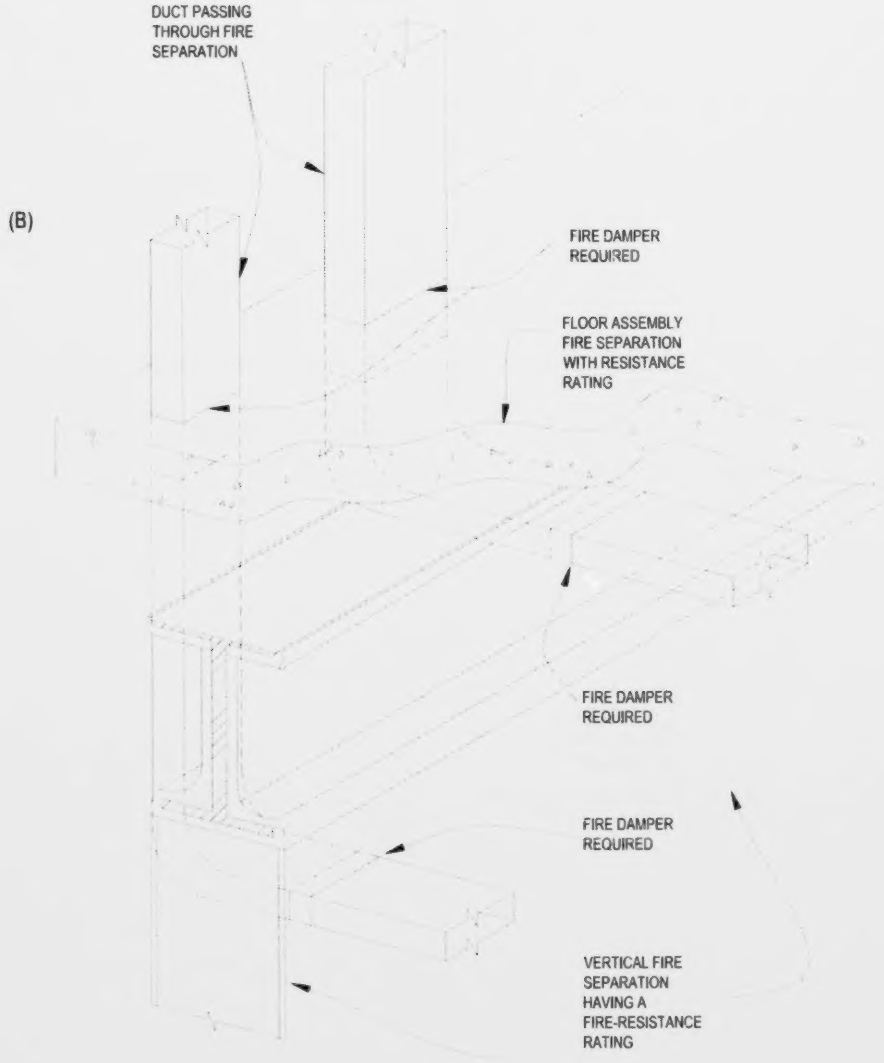

DUCT PASSING THROUGH FIRE SEPARATION
(B)
FIRE DAMPER REQUIRED
FLOOR ASSEMBLY FIRE SEPARATION WITH RESISTANCE RATING
FIRE DAMPER REQUIRED
FIRE DAMPER REQUIRED
VERTICAL FIRE SEPARATION HAVING A FIRE-RESISTANCE RATING

FIGURE 2-2 (B)

Distinction Between Fire Separation
and Fire-Resistance Rating (F.R.R.)

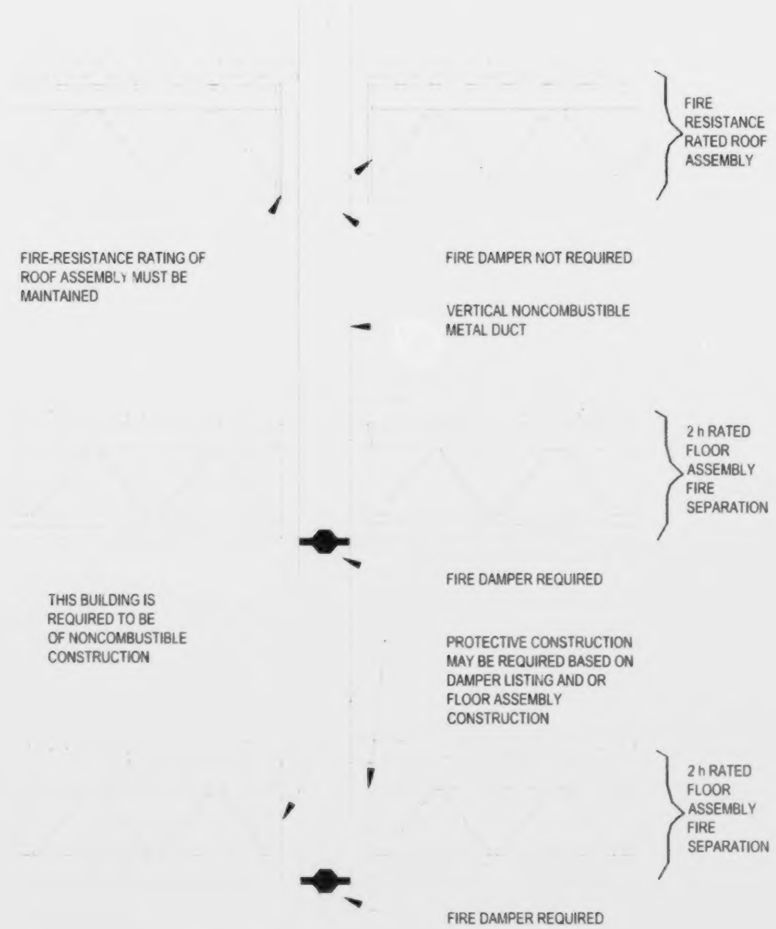

FIRE RESISTANCE RATED ROOF ASSEMBLY
FIRE-RESISTANCE RATING OF ROOF ASSEMBLY MUST BE MAINTAINED
FIRE DAMPER NOT REQUIRED
VERTICAL NONCOMBUSTIBLE METAL DUCT
2 h RATED FLOOR ASSEMBLY FIRE SEPARATION
FIRE DAMPER REQUIRED
THIS BUILDING IS REQUIRED TO BE OF NONCOMBUSTIBLE CONSTRUCTION
PROTECTIVE CONSTRUCTION MAY BE REQUIRED BASED ON DAMPER LISTING AND OR FLOOR ASSEMBLY CONSTRUCTION
2 h RATED FLOOR ASSEMBLY FIRE SEPARATION
FIRE DAMPER REQUIRED

FIGURE 2-2 (C)

EXERCISE #2-2

Answer the following questions in the space provided. What do other members of the group think? Class discussion will begin in 15 minutes.

1. Define the term 'horizontal service space'.

   ____

   ____

   ____

   ________________________ [____________]

2. Figure 2-3 illustrates the general rule of Sentence 3.1.8.3.(1). In the space provided, explain in your own words the general rule for horizontal service spaces or other concealed spaces located above a required vertical fire separation, including the wall of a shaft.

   ____

   ____

   ____

   ________________________ [____________]

Continuity of a Vertical Fire Separation
Sentences 3.1.8.3.(1) and (2)

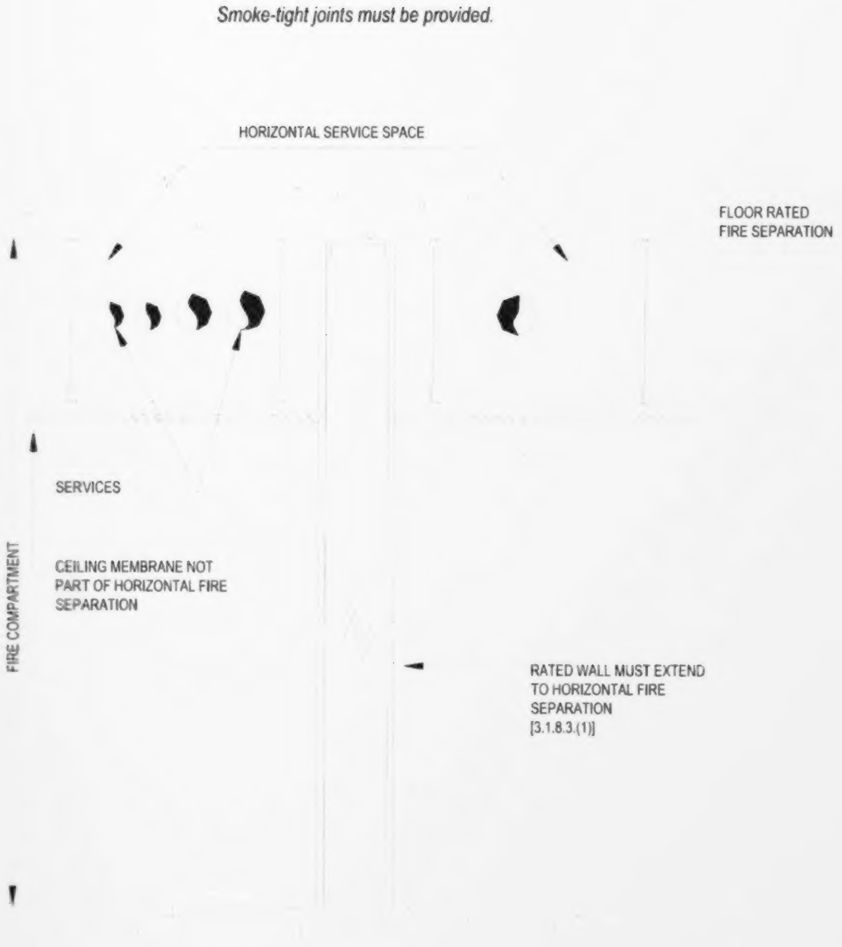
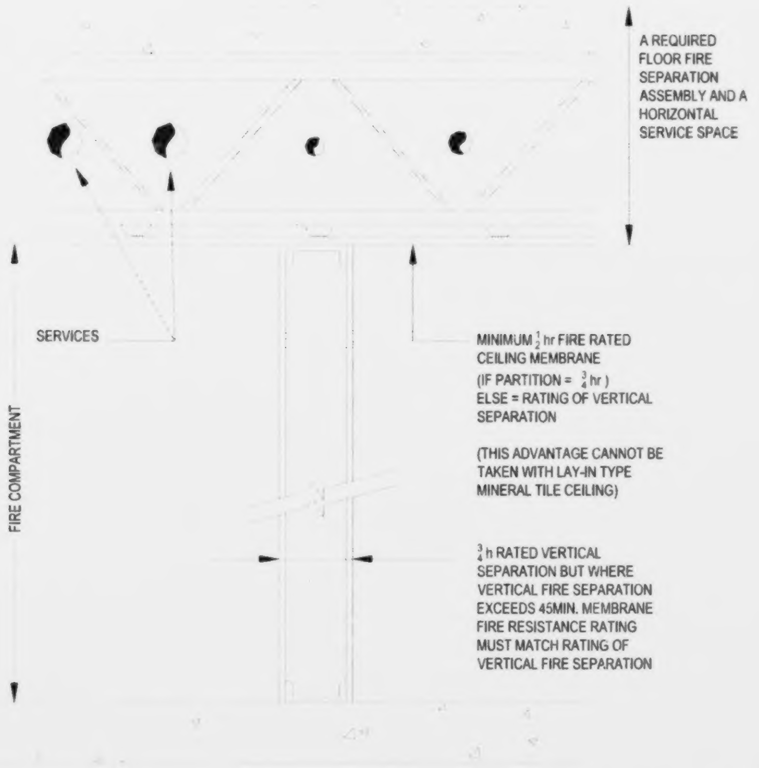

Smoke-tight joints must be provided.
HORIZONTAL SERVICE SPACE
FLOOR RATED FIRE SEPARATION
SERVICES
FIRE COMPARTMENT
CEILING MEMBRANE NOT PART OF HORIZONTAL FIRE SEPARATION
RATED WALL MUST EXTEND TO HORIZONTAL FIRE SEPARATION [3.1.8.3.(1)]

FIGURE 2-3

Continuity of a Vertical Fire Separation Abutting Below a Horizontal Service Space Having a Rated Ceiling Membrane - Sentence 3.6.4.2.(2)



A REQUIRED FLOOR FIRE SEPARATION ASSEMBLY AND A HORIZONTAL SERVICE SPACE

MINIMUM $\frac{1}{2}$ hr FIRE RATED CEILING MEMBRANE
(IF PARTITION = $\frac{3}{4}$ hr)
ELSE = RATING OF VERTICAL SEPARATION

(THIS ADVANTAGE CANNOT BE TAKEN WITH LAY-IN TYPE MINERAL TILE CEILING)

$\frac{3}{4}$ h RATED VERTICAL SEPARATION BUT WHERE VERTICAL FIRE SEPARATION EXCEEDS 45MIN. MEMBRANE FIRE RESISTANCE RATING MUST MATCH RATING OF VERTICAL FIRE SEPARATION

FIGURE 2-4

3. Figure 2-4 illustrates the exception contained in Sentence 3.6.4.2.(2) to the general rule for a horizontal service space or other concealed space located above a required vertical fire separation that is not the wall of a vertical shaft. Explain what the OBC requires when a vertical fire separation terminates at the underside of a horizontal service space.

STOP

Closures (3.1.8.4., 3.1.8.5.)

According to Division A, Article 1.4.1.2., closure means "a device or assembly for closing an opening through a fire separation or an exterior wall, such as a door, a shutter, wired glass or glass block, and includes all components such as hardware, closing devices, frames and anchors". In this module, we will focus on what the Code says about closures.

General Overview

Most fire separations have openings through them. When this is the case, proper installation of closures is necessary to ensure that the fire compartment is effectively separated from the rest of the building. When assessing the adequacy of closures, the following must be taken into consideration:

- The labelled fire protection rating (FPR) of the closure
- Installation of a labelled frame
- Installation of labelled hardware
- Recognition of various referenced standards associated with closures
- The treatment accorded untested closures.

This part of the module will deal with each of these matters separately.

STOP

FIRE PROTECTION RATING

It is the time, in minutes or hours, that a closure will withstand the passage of flame when exposed to fire under specified conditions of test and performance criteria, or as otherwise prescribed in the Code [Division A, Article 1.4.1.2.].

The fire protection rating of a closure can be determined as follows:

- First determine the fire-resistance rating of the fire separation from other requirements in the Code, then determine the closure rating based on Table 3.1.8.4.
- Fire protection rating can be determined by testing, or
- On site confirmation of labels stating the fire protection rating of the closures.

Frame Installation

The frame is part of the closure that ensures the integrity of a fire separation at an opening. In a fire, a metal door will curve in the direction of the fire. The same holds true for fire windows or shutters. As a result, the frame for these closures must be securely anchored into the wall.

The exact opposite is true of fire dampers: they are positioned in a sleeve, which is loosely installed in the floor or wall.

Self-Closing Devices (3.1.8.11.)

Self-closing devices, like fire doors, are required to be labelled to ensure the required fire protection rating.

STOP

EXERCISE #2-3

Read Article 3.1.8.11. Answer the questions.

1. When it comes to self-closing devices, specify the general rule for doors in a fire separation (other than doors to freight elevators and dumbwaiters).

   ____

   ______________________________ [______________]

2. There are four exceptions to this general rule. Name three locations where self-closing devices need not be provided on fire doors, and specify any applicable condition. (Do not deal with sprinklered hospitals and nursing homes.)

   ____

   ____

   ______________________________ [______________]

Latches or Locks (3.1.8.13.)

The use of latches on fire doors is governed by Article 3.1.8.13. Remember that the terms lock and latch are used interchangeably. The function of either is to hold a fire door in the closed position under a fire condition. Locks and latches must be labelled to the required FPR, to maintain the listing of the fire door assembly.

Article 3.1.8.13. refers to a positive latching mechanism. This means that the latch bolt must by mechanical means engage in the latch strike. It does not permit the use of roller latches or magnetic locks to hold the door in the closed position.

STOP

EXERCISE #2-4

Read the above Code reference and answer the questions.

1. State the general rule governing the latching mechanism of every swing-type door in a fire separation.

   ____

   ____

   ____________________________ [______________]

2. There are exceptions to this general rule, as certain doors in a fire separation are not required to be equipped with a positive latching mechanism. Describe their location and state any application condition.

   ____

   ____

   ____________________________ [______________]

STOP

Fire Dampers (3.1.8.7., 3.1.8.8., 3.1.8.9.)

A fire damper is a closure that protects an opening created by an air duct connecting two fire compartments. Its use is regulated by Articles 3.1.8.7. to 3.1.8.9. of the Code.

STOP

EXERCISE #2-5

Read the appropriate Articles of the Code. You have about 15 minutes to answer the questions. In each case, provide the Code reference.

1. State the two general rules that dictate when a fire damper must be installed in a duct.

   ____

   ____

   __________________________ [____________]

2. Where a fire damper acts as a closure, explain how the required fire protection rating is determined.

   ____

   ____

   __________________________ [____________]

3. The OBC tells us that fire dampers tested in the vertical or horizontal position must be installed in the manner in which they were tested. Additionally, they are to be installed in the plane of the fire separation, so as to stay in place should the duct be dislodged during a fire. To which standard are they tested?

____

____

________________________ [____________]

4. Consider a noncombustible branch duct with a melting point above 760ºC that penetrates a required fire separation. Would a fire damper be required if the duct served only a heating unit?

____

____

________________________ [____________]

5. There are a number of situations in which a duct either connects two fire compartments or penetrates an assembly required to have a fire-resistance rating, but does not require a fire damper to ensure the continuity of the fire separation.

   a) Serving air-conditioning units or combined air-conditioning and heating units.

Four conditions apply. State them.

____

____

____

____________________________ [____________]

b) Fire dampers can be omitted from branch ducts that are connected to exhaust duct risers. State the conditions that must be adhered to.

____

____

____________________________ [____________]

STOP

Temperature Rise on Fire Doors (3.1.8.15., 3.1.8.17.)

Some fire doors are required to meet temperature rise criteria. The term temperature rise refers to the temperature developed on the unexposed face of the door at the end of 30 or 60 minutes of a fire endurance test, in conformance with CAN4-S104, "Fire Tests of Door Assemblies". Those labels that do not show temperature rise are for doors that develop temperature rises in excess of 250°C during the first 30 minutes of fire exposure.

EXERCISE #2-6

The matter of temperature rise on fire doors is dealt with in Articles 3.1.8.15. and 3.1.8.17.

Take about five minutes to read those Articles and Table 3.1.8.15.

1. Consider Table 3.1.8.15. and make a list of the locations where the use of a fire door is regulated by the maximum temperature rise on the opaque portion of the unexposed side of the fire door.

   ____

   ____

   ____________________________ [______________]

2. Specify the three conditions that waive the temperature rise limitations for a fire door located between an exit enclosure and an enclosed vestibule, or between an exit enclosure and a corridor, or between an exit enclosure and the remainder of the floor area in a building not more than 3 storeys in building height.

   ____

   ____

   ____

   ____________________________ [______________]

Sprinkler Protected Glazed Wall Assembly (3.1.8.18.)

Another means of providing a closure in an opening in a fire separation is to use a sprinkler protected, glazed wall assembly constructed in accordance with ULC/ORD-C263.1, "Sprinkler Protected Window Systems" [3.1.8.18.(1)].

These assemblies can be used in any type of fire separation with the following exceptions:

- not more than 2 hour FRR [3.1.8.18.(2)(a)]
- not in firewalls [3.1.8.18.(2)(b)]
- not in F1 occupancies [3.1.8.18.(2)(c)]
- not in any part of an exit serving:
  - floor area subject to 3.2.6. [3.1.8.18.(2)(d)(i)]
  - care/detention occupancy [3.1.8.18.(2)(d)(ii)]
  - residential occupancy [3.1.8.18.(2)(d)(iii)].

When a sprinkler protected window assembly is installed in an exit enclosure, the building shall be:

- sprinklered, and
- protected exits cannot comprise more than 50% of the required exits from any floor area [3.1.8.18.(3)].

Sprinkler protected window assemblies include:

- framing
- specified glazing
- special sprinkler heads on both sides of glazing, and specified water flow requirements
- no horizontal mullions
- size limitations (see listings)
- sprinkler protected window assemblies are listed by accredited certification organizations and bear labels on components (like fire doors, fire dampers).

STOP

Firestopping (3.1.9.1.)

Firestops are elements of building assemblies that are installed at strategic locations to resist the passage of fire from one space to another. Although the term 'firestop' is not defined, there are two applications related to the concept of compartmentation.

One is to maintain the integrity of a fire separation, as directed by Article 3.1.8.1. We saw that openings in a required fire separation are usually protected with closures to ensure the continuity of fire separations. We will now learn the rules of the Building Code for building services that penetrate a membrane forming part of an assembly required to have a fire-resistance rating (FRR) or a fire separation. The function of a service penetration firestop is to maintain the integrity of the fire separation by addressing any opening around a pipe, wire or other building service and the fire separation or its membrane.

The second use of firestops is to limit the size of concealed spaces such as stud cavities, crawl spaces, attic or ceiling spaces, and spaces between the superstructure and the exterior building envelope by creating draft-tight compartments. Generally, because other components of the fire separation must be breached by the fire before reaching the firestop material, the rating of such firestop material is less than that of the fire separation. This type of firestopping is commonly referred to as 'fire blocks'.

The Rationale for Firestopping

When fire separations are not continuous due to small gaps along a service penetration, draft air can circulate from one fire compartment to the next.

The importance of proper firestopping was brought home in a study conducted in 1977 by the United States Center for Fire Research. They found out that in 29 out of 84 fires in low-rise residential buildings in Washington, D.C., fire spread resulted from inadequate firestopping.

Firestop systems are rated by way of tests that measure the ability of the system to remain in the opening, prevent passage of flame, and other criteria when exposed to a standard fire test exposure. The differential pressure between the surfaces of the system exposed to fire and those which are not is also measured. Those intended for installation in fire separations are assigned fire ratings by being tested in accordance with ULC-S115-M, "Fire Tests of Firestop Systems". Four ratings (F, FT, FH and FTH) are assigned as follows:

F The system receives the most basic rating, the F rating, if it remains in the opening during the fire test without permitting the passage of flame through the opening, and does not support flaming on any element of the unexposed side of the assembly.

T In addition to meeting the criteria for the F rating, the firestop system receives a T rating if the unexposed surface does not warm to more than 181°C more than its initial temperature during the rating period.

H In addition to meeting the criteria for the F rating, the system is awarded an H rating if it remains in the opening during the fire test and hose stream without permitting a projection of water from the stream beyond the unexposed side.

STOP

EXERCISE #2-7

Read Article 3.1.9.1. and answer the following questions. Class discussion will begin in 5 minutes.

1. When a service penetration as described in Sentence 3.1.9.1.(1) is not tightly fitted, describe the firestop system required and explain how its fire protection rating is determined.

   [ ]

2. Sentence 3.1.9.1.(2) deals with service penetrations of two particular types of fire separations.

   a) In your own words, describe the two types of fire separations.

   [ ]

   b) When a service penetrates a firewall or a horizontal fire separation whereby a storage garage is considered a separate building, the service penetration of piping, tubing, ducts, chimneys, electrical wires and cables, totally enclosed in noncombustible conduits, electrical outlet boxes and similar building services are not simply permitted to be tightly fitted. Describe the firestop system required and explain how its fire protection rating is determined.

STOP

Combustibility of Service Penetrations (3.1.9.2.)

Article 3.1.9.2. provides us with a general rule: When pipes, ducts, electrical outlet boxes, totally enclosed conduits or other similar service equipment that partly or wholly penetrate an assembly required to have a fire-resistance rating, such service penetrations shall be of noncombustible material unless the assembly has been tested incorporating such equipment.

In the next exercises, we will deal with penetrations by wires, cables and outlet boxes, and by combustible piping - two exceptions to this rule.

STOP

EXERCISE #2-8

You have 10 minutes to read Article 3.1.9.3., to answer the questions below, and to prepare yourself for the class discussion that will follow. Support your answers with a Code reference.

1. An opening is made through the membrane of a fire separation that is required to have a fire-resistance rating, in order to install a combustible outlet box. Specify the maximum untested size of the opening.

   ____

   ____________________________ [____________]

2. What must be done when outlet boxes penetrate opposite sides of the same fire separation?

   ____

   ____

   ____________________________ [____________]

3. Under which condition can wiring of any size, with unrated combustible insulation, jackets or sheathes, be permitted to partly or wholly penetrate an assembly required to have a fire-resistance rating without the benefit of a test?

   ____

   ____________________________ [____________]

4. Considering that the electrical wires or cables, single or grouped, not totally enclosed in noncombustible conduit, with combustible insulation, jackets or sheathes, which are permitted to partly or wholly penetrate an assembly required to have a fire-resistance rating without being incorporated in the assembly at the time of testing, provided that two conditions are complied with. Specify them.

____

____

____________________________ [______________]

STOP

The following Table provides a summary of the minimum ratings of firestop systems found in OBC Articles 3.1.9.1. and 3.1.9.4.

TABLE 2-5

Minimum Ratings of Firestop Systems

FRR of Fire Separation	Noncombustible Service Penetration in A fire Separation Not a Firewall	Noncombustible Service Penetration in a Firewall	Combustible Piping Penetration in a Fire Separation Not in a Firewall‡*	Combustible Piping Penetration in a Firewall*
30 min	20 min F	—	30 min F @ 50 Pa	
45 min	45 min F	—	45 min F @ 50 Pa	
1 h	45 min F	—	1 h F @ 50 Pa	
1.5 h	1 h F	—	1.5 h F @ 50 Pa	
2 h	1.5 h F	2 h FT	2 h F @ 50 Pa	2 h FT @ 50 Pa
3 h	2 h F	—	3 h F @ 50 Pa	
4 h	—	4 h FT	—	4 h FT @ 50 Pa

OBC reference: Clause 3.1.9.1.(1)(a); Sentence 3.1.9.1.(2); Clause 3.1.9.4.(4)(a)

The F and FT ratings are established from the results of fire tests conforming to ULC-S115, "Fire Tests of Firestop Systems"

‡ - Applies to nonsprinklered buildings

* - 50 Pa refers to the pressure difference between the exposed and unexposed side of the firestop system when tested in conformance with ULC-S115.

Firewalls (3.1.10.)

Firewalls are a special type of masonry or concrete or equivalent fire separation that subdivide a building into two or more entities and have a fire-resistance rating of 2 or 4 hours.

Firewalls are incorporated into the design of a building by a designer in order to 'reduce' the building area. In effect, their presence divides a building into two or more entities. The parts, which have a lesser building area, may be considered as individual, separate buildings for purposes of fire protection according to the Code.

This 'area reduction' does not apply to the determination of gross area, nor to the requirement for a fire alarm and detection system when there are penetrations of a firewall. Division A, Article 1.1.3.1. in company with the definition of gross area, informs us that the Code would apply as though the two entities separated by a firewall were one building, with the exception of a Group C occupancy.

A firewall may be constructed within a building on one property and under one ownership so that less stringent structural fire protection requirements can be applied to each portion. The building area of each portion is less than that for the whole building, since by definition the building area can be bounded by a firewall. The firewall effectively divides the building into smaller buildings, and the structural fire safety requirements for the individual portions can be less than they would be for the building as a whole. If there are doorways or other large openings through a firewall, an exception is made to this generalized permission to consider the portions independently, because a fire alarm system must be designed as though the structure were one building.

Structural Integrity (3.1.10.1.)

The structural integrity of a firewall is just as important as its fire-resistance rating. If the firewall does not remain in place for the specified time, it cannot act as a barrier against the spread of fire.

Construction of Firewall by Other than Masonry or Concrete [3.1.10.2.(4)]

Firewalls with FRR of 2 hours may be constructed of other than masonry or concrete, provided:

- they are protected against damage affecting their integrity
- they are designed in accordance with Article 4.1.5.18.
- their level of performance is equivalent to masonry or concrete under:
  - fire conditions
  - mechanical damage resistance, and
  - moisture resistance.
- they are not used to separate Group B1 or B2 major occupancies, and
- they are not used to separate buildings regulated by 3.2.6. (high buildings).

STOP

EXERCISE #2-9

Figure 2-5 illustrates various types of firewalls in one storey buildings. Take about 5 minutes to review them. Then read Article 3.1.10.1. Answer the questions, supporting your answer with a Code reference.

1. Illustrations A and B in Figure 2-5 reveal that the connected roof assemblies adjoining the firewall do not have a verifiable fire-resistance rating. Specify the Code requirement for the design of the firewall-roof connection.

   ____

   ____

   ____

   ________________________ [____________]

2. Explain the circumstances that would allow a firewall to be supported by the structural frame of a building.

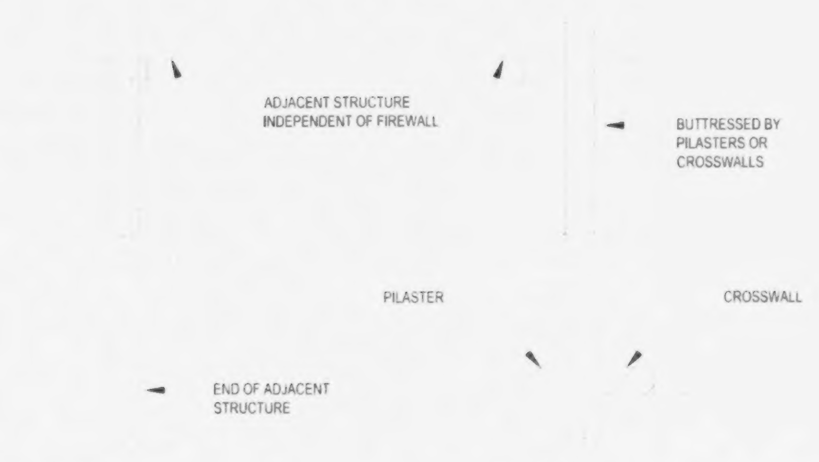
   ____

   ____

   ____

   ________________________ [____________]

Typical Firewalls with Parapet


ADJACENT STRUCTURE INDEPENDENT OF FIREWALL
BUTTRESSED BY PILASTERS OR CROSSWALLS
PILASTER
CROSSWALL
END OF ADJACENT STRUCTURE

PLAN

A) REINFORCED CONCRETE
ROOF UNRATED

PLAN

B) SUPPORTED BY PILASTERS
ROOF UNRATED

2 h FIREWALL
2 h RATED ROOF/CEILING ASSEMBLY
½ RATING
INDEPENDENT WALL SUPPORTING ROOF STRUCTURE

SECTION

C) WITH ROOF ASSEMBLY
OF EQUIVALENT F.R.R.

SECTION

D) DOUBLE WALL
ROOF UNRATED
3.1.10.1.(2)

FIGURE 2-5

Flame Spread Rating and Interior Finishes (3.1.12., 3.1.13.)

Understanding the Code

At first reading, Subsection 3.1.13. appears to be very complicated. In reality, the surface burning characteristics of interior finishes can be broken down among three types of buildings:

- Buildings permitted to be of combustible construction
- Buildings required to be of noncombustible construction
- High buildings regulated by Subsection 3.2.6.

In this course, we do not deal with buildings regulated by Subsection 3.2.6.

A location, occupancy, or other element under consideration in a non-3.2.6. building can be further subcategorized as to whether it is sprinklered or unsprinklered.

Over the next few pages, charts are provided that identify the flame spread ratings (FSR) of interior wall and ceiling finishes and present the rules associated with each of four combinations of factors. The factors are:

- wall installation
- ceiling installation
- surface - rating applies to surface of material only
- cut test - rating applies to any surface of the material that can be exposed by cutting through the material in any direction.

These tables become a handy reference for your on-the-job needs.

TABLE 2-6

Noncombustible Construction, Unsprinklered

Occupancy, Location or Element		Maximum FSR		Code Reference(s) Sentences 3.1.13.2.(1), (4), (5); Table 3.1.13.2.
		Surface	Cut Test	
A1 Occupancies, Including Doors, Skylights, Glazing, Light Diffusers and Lenses	walls	75[1]	150[2]	as above, in header ☞Clause 3.1.5.10.(2)(b)
	ceiling	75[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Group B Occupancies (see Table 2-7)	walls	n/a[9]	n/a[9]	building must be sprinklered
	ceiling	n/a[9]	n/a[9]	building must be sprinklered
Exits	walls	25[1]	25[1]	as above & 3.1.13.8.(1)(b)
	ceiling	25[3]	25[3]	as above & 3.1.13.8.(1)(b)
	floor	25	25	as above & 3.1.13.8.(1)(b)
Exterior Exit Passageways, Singly	walls	25[5]	25[5]	as above ☞Article 3.1.13.10.
	ceiling	25[5]	25[5]	as above ☞Article 3.1.13.10.
Exit Lobbies Regulated by Sentence 3.4.4.2.(2)	walls	25[6]	25[6]	as above ☞3.1.13.8.(1)(b)
	ceiling	25[3]	25[3]	as above ☞3.1.13.8.(1)(b)
Covered Vehicular Passageways, Except Heavy Timber Roof Assemblies	walls	25[1]	150[2]	as above ☞3.1.5.10.(2)(b)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Vertical Service Spaces	walls	25[1]	150[2]	as above ☞3.1.5.10.(2)(b)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Doors, Except A1 Occupancies		200[7]	—	Sentences 3.1.13.2.(2), (3)
Bathrooms within Group C Occupancies	walls	200	—	as above ☞Article 3.1.13.3.
	ceiling	200	—	as above ☞Article 3.1.13.3.
Corridors, Public & Other Types Not within Suites or Rooms	walls	75[8]	150[2]	as above ☞Article 3.1.13.6.(1)(a)
	ceiling	25[3]	25[4]	as above ☞3.1.5.10.(3)(b)
Plenums, All Surfaces	SDC: 50	25	—	Clause 3.6.4.3.(1)(a)
Other Areas	walls	150	150[2]	Clause 3.1.5.10.(2)(b)
	ceiling	150	25[4]	Clause 3.1.5.10.(3)(b)

1 Sentences 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR $\leq$ 150.
2 Maximum cross-sectional FSR for combustible interior wall finishes.
3 Sentences 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1 occupancies, FSR $\leq$ 150.
4 Maximum cross-sectional FSR for combustible interior ceiling finishes.
5 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR $\leq$ 150.
6 Sentences 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR $\leq$ 150.
7 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.
8 Clause 3.1.13.6.(1)(b), or upper half of wall FSR $\leq$ 25 and lower half of wall FSR $\leq$ 150.
9 Articles 3.2.2.36. ☞ 3.2.2.41. require B occupancies to be sprinklered.

TABLE 2-7

Noncombustible Construction, Sprinklered

Occupancy, Location or Element		Maximum FSR		Code Reference(s) Sentence 3.1.13.2.(1) Table 3.1.13.2.
		Surface	Cut Test	
A1 Occupancies, Including Doors, Skylights, Glazing, Light Diffusers and Lenses	walls	150^{2}	150^{1}	as above ☞ Clause 3.1.5.10.(2)(b)
	ceiling	25^{2}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)
Group B Occupancies	walls	150	150^{1}	as above ☞ Clause 3.1.5.10.(2)(b)
	ceiling	25^{2}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)
Exits	walls	25^{4}	25^{4}	as above
	ceiling	25^{2}	25^{2}	as above ☞ Clause 3.1.5.10.(3)(b)
	floor	25	25	as above & Clause 3.1.13.8.(1)(b)
Exterior Exit Passageways, Singly	walls	25^{5}	25^{5}	as above ☞ Article 3.1.13.10.
	ceiling	25^{5}	25^{5}	as above ☞ Article 3.1.13.10.
Exit Lobbies Regulated by Sentence 3.4.4.2.(2)	walls	25^{6}	25^{6}	as above
	ceiling	25^{2}	25^{2}	as above ☞ Clause 3.1.5.10.(3)(b)
Covered Vehicular Passageways, Except Heavy Timber Roof Assemblies	walls	25^{4}	150^{1}	as above
	ceiling	25^{2}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)
Vertical Service Spaces	walls	25^{4}	150^{1}	as above
	ceiling	25^{3}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)
Doors, Except A1 Occupancies		200	—	Sentences 3.1.13.2.(2), (3)
Bathrooms within Group C Occupancies	walls	[illegible]00	—	as above ☞ Article 3.1.13.3.
	ceiling	200	—	as above ☞ Article 3.1.13.3.
Corridors, Public & Other Types Not within Suites or Rooms	walls	150	150^{1}	as above ☞ Clause 3.1.5.10.(2)(b)
	ceiling	25^{2}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)
Plenums, All Surfaces	SDC: 50	25	—	Clause 3.6.4.3.(1)(a)
Other Areas	walls	150^{1}	150^{1}	as above ☞ Clause 3.1.5.10.(2)(b)
	ceiling	150^{1}	25^{3}	as above ☞ Clause 3.1.5.10.(3)(b)

1 Maximum cross-sectional FSR for combustible interior wall finishes.
2 Sentences 3.1.13.2.(4) & (5), 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1 occupancies, FSR ≤ 150.
3 Maximum cross-sectional FSR for combustible interior ceiling finishes.
4 Sentences 3.1.13.2(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR ≤ 150.
5 Article 3.1.13.10.: up to 10% of total wall/ceiling area, FSR ≤ 150.
6 Sentences 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1 occupancies, FSR ≤ 150.

STOP

The following two Tables (2-8 and 2-9) provide a handy reference for maximum required flame spread ratings for buildings permitted to be of combustible construction.

TABLE 2-8
Combustible Construction, Unsprinklered

Occupancy, Location or Element		Maximum FSR (Surface Flame Spread)	Code Reference(s) Sentences 3.1.13.2.(1), (4), (5): Table 3.1.13.2.
A1 occupancies, including doors, skylights, glazing, light diffusers & lenses	walls	75[1]	as above, in header
	ceiling	75[2]	as above
Group B occupancies	walls	n/a[7]	
	ceiling	n/a[7]	
Exits	walls	25[1]	as above
	ceiling	25[2]	as above
Exterior exit passageways, singly	walls	25[3]	as above ☞Article 3.1.13.10.
	ceiling	25[3]	as above ☞Article 3.1.13.10.
Exit lobbies regulated by Sentence 3.4.4.2.(2)	walls	25[4]	as above
	ceiling	25[2]	as above
Covered vehicular passageways, except heavy timber roof assemblies	walls	25[1]	as above
	ceiling	25[2]	as above
Vertical service spaces	walls	25[1]	as above
	ceiling	25[2]	as above
Doors, except A1 occupancies		200[5]	Sentences 3.1.13.2.(2), (3)
Doors, within residential suites		no limit	Sentence 3.1.13.2.(3)
Bathrooms within Group C occupancies	walls	200	as above ☞Article 3.1.13.3.
	ceiling	200	as above ☞Article 3.1.13.3.
Corridors, public and other types not within suites or rooms	walls	75[6]	as above ☞Clause 3.1.13.6.(1)(a)
	ceiling	25	as above ☞Sentence 3.1.13.6.(2)
Plenums, all surfaces	SDC: 50	25	Clause 3.6.4.3.(1)(a)
Other areas	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)

1 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.

2 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1, FSR $\leq$ 150.

3 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR $\leq$ 150.

4 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.

5 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.

6 Clause 3.1.13.6.(1)(b), or upper half of wall FSR $\leq$ 25 and lower half of wall FSR $\leq$ 150.

7 Articles 3.2.2.36. ☞3.2.2.41. Require sprinklers.

TABLE 2-9

Combustible Construction, Sprinklered

Occupancy, Location or Element		Maximum FSR (Surface Flame Spread)	Code Reference(s) Sentences 3.1.13.2.(1); Table 3.1.13.2.
A1 occupancies, including doors, skylights, glazing, light diffusers & lenses	walls	150	as above, in header
	ceiling	150	as above
Group B occupancies	walls	150	as above
	ceiling	150	as above
Exits	walls	25^1	as above
	ceiling	25^2	as above
Exterior exit passageways, singly	walls	25^3	as above ☞ Article 3.1.13.10.
	ceiling	25^3	as above ☞ Article 3.1.13.10.
Exit lobbies regulated by Sentence 3.4.4.2.(2)	walls	25^4	as above
	ceiling	25^2	as above
Covered vehicular passageways, except heavy timber roof assemblies	walls	25^1	as above
	ceiling	25^2	as above
Vertical service spaces	walls	25^1	as above
	ceiling	25^2	as above
Doors, except A1 occupancies		200^5	Sentences 3.1.13.2.(2), (3)
Doors, within residential suites		no limit	Sentence 3.1.13.2.(3)
Bathrooms within Group C occupancies	walls	200	as above ☞ Article 3.1.13.3.
	ceiling	200	as above ☞ Article 3.1.13.3.
Corridors, public and other types not within suites or rooms	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)
Plenums, all surfaces	SDC: 50	25	Clause 3.6.4.3.(1)(a)
Other areas	walls	150	Sentence 3.1.13.2.(1)
	ceiling	150	Sentence 3.1.13.2.(1)

1 3.1.13.2.(4) & (5): 10% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.
2 3.1.13.2.(4) & (5): 10% of total ceiling area, not counting skylights, light diffusers and lenses in non-A1, FSR $\leq$ 150.
3 Article 3.1.13.10.: up to 10% of total wall/ceiling area FSR $\leq$ 150.
4 3.1.13.2.(4) & (5): 25% of total wall area, not counting combustible doors and glazing in non-A1, FSR $\leq$ 150.
5 Sentence 3.1.13.2.(3): no limit on FSR where door is in a dwelling unit.

Fabrics (3.1.16.)

Fabrics used as part of an awning, canopy or marquee located or attached to any type of building must demonstrate flame resistance properties by conforming to CAN/ULC-S109.

This requirement also applies to:

- tents [3.14.1.6.(1)]
- air-supported structures [3.14.2.5.(1)]
- duct tape [6.2.3.17.(1) and 6.2.4.9.(1)].

The Ontario Fire Code also references CAN/ULC-S109 for draperies, and other free hanging fabric and film applications.

These requirements assess materials that by their nature and method of application can propagate flame from either side if ignited (not attached to substrate like an interior finish) and can melt and drip and contribute to fire growth within a compartment.

Occupant Load (3.1.17.)

The principal application of occupant load is to determine the minimum number and width of exit facilities to be provided, as well as the width of access routes leading to exits from within floor areas. As well, occupant load is used to determine the number of required plumbing fixtures.

Table 3.1.17.1. identifies a standard to determine the anticipated number of persons in a building. It is not intended to restrict the number of persons that can occupy an area; it is sometimes erroneously interpreted that way. For example, in the case of offices, the Table shows 9.30 m^2 per person. It is permissible for offices to have less space per person. In such cases, the occupant load of the office would be higher than that normally anticipated. In turn, the higher value would be used to compute the various Code requirements that are directly linked to occupant load.

Effect of Occupant Load

Based on occupant load, a building may require:

- a fire alarm and detection system; or
- Compliance with additional requirements for high buildings.

Occupant load is also used to determine the following:

- Use of panic/fire exit hardware on doors
- Number of egress doorways from a room/suite
- Number of exits from a floor area
- Width of exit/egress doors
- Width of corridors, various types
- Width of exit/egress stairs
- Number of plumbing fixtures
- Need for emergency lighting.

Before we can practice calculating occupant load, we must first understand the meaning of the term.

EXERCISE #2-10

Consider Figure 2-6 in order to do two things:

1. Use your pen to highlight the 'floor area' part of the floor plan.

2. Calculate the floor area in Figure 2-6 assuming the thickness of the exterior wall is 300 mm and the balcony is 1.5 m wide.

____

____

STOP

Typical Floor Plan of a Multi-Storey Office Building

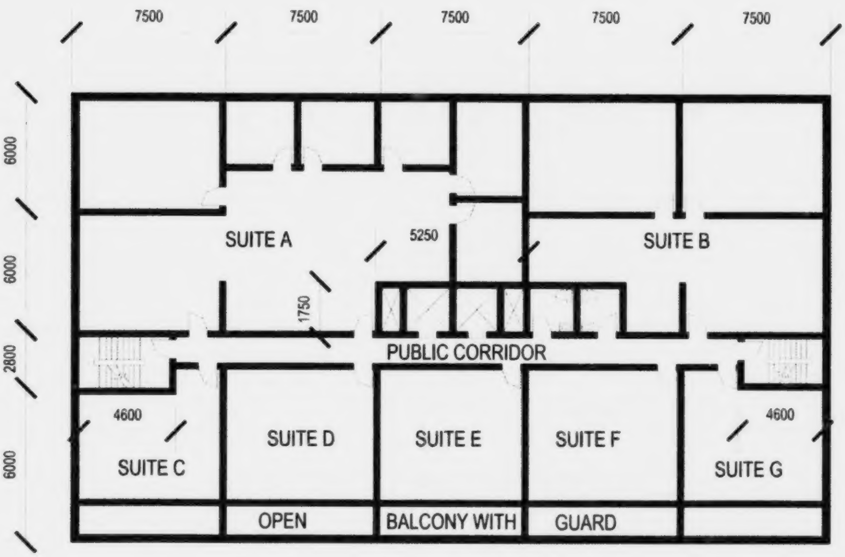

7500
7500
7500
7500
7500
6000
6000
2800
6000
SUITE A
5250
SUITE B
1750
PUBLIC CORRIDOR
4600
4600
SUITE C
SUITE D
SUITE E
SUITE F
SUITE G
OPEN
BALCONY WITH
GUARD

FIGURE 2-6

Calculating Occupant Load

The calculation of occupant load, which is primarily a plans examination function, requires four basic steps.

Step 1:Calculate the Floor Area

Calculate the floor area from the information contained on the architectural floor plans

Step 2:Determine the Use(s)

Determine the use or uses of all floor areas within the building. The determination is based on the information shown on the architectural floor plans. Such information could include stated uses, equipment description and layout, and furniture layouts.

In carrying out this step, you must be sensitive to the different and many uses that a building may be put to. Exposure to day-to-day uses, the study of social functions, the study of industrial processes, and the use of common sense will prove valuable assets in effectively determining occupant load.

Step 3:Confirm the Method of Calculation

1. Consider the presence of bedrooms, and determine the occupant load.

2. Consider the presence of fixed seats, and determine the occupant load.

3. When the occupant load is determined from Table 3.1.17.1., refer to the Table and take notes.

   Locate the use in column one, and note the area per person in column two, in line with the located use.

Step 4: Calculate the Occupant Load from Table 3.1.17.1.

When using Table 3.1.17.1., you calculate the occupant load by dividing the floor area in square metres (Step 1) by the area per person in square metres (Step 3, Part 4).

$$\frac{\text{floor area } (\mathrm{m}^2)}{\text{area per person } (\mathrm{m}^2)} = \text{occupant load}$$

Round up to the nearest whole number.

EXERCISE #2-11

Assume that the floor area of a large restaurant dining area is 800 m^2. From Table 3.1.17.1., calculate the occupant load of the dining area. Take five minutes to determine the answer.

Occupant load calculation:

____

____

____

____

STOP

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MODULE 3

LARGE BUILDINGS – 2006

SUPPLEMENTARY STANDARD SB-2

FIRE PERFORMANCE RATINGS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

3.1 INTRODUCTION

Supplementary Standard SB-2 forms part of the Building Code. The information contained in SB-2 is referenced throughout Division B, Part 3 and Part 9 of the Code.

In this module, we will examine the contents of Supplementary Standard SB-2 as it relates to the requirements found in Division B, Part 3.

We will study the methods used for calculating fire-resistance ratings, using 'generic materials' that can be described using referenced product standards. We will learn how to use the Tables providing ratings of materials for flame-spread, smoke developed classifications, and noncombustibility.

Objectives

In this module, you will be able to:

- provide an understanding of where to locate information on fire-resistance ratings, flame-spread ratings, smoke developed classifications, noncombustibility and protection of openings in fire-rated assemblies
- understand and be able to calculate equivalent thicknesses
- understand and be able to calculate fire-resistance ratings of assemblies using the 'component additive method'
- understand and be able to calculate M/D ratios for steel columns
- reference applicable standards.

Read page SB 2-1, page 1 from beginning to 1.1.1.(3).

SB-2 is formatted into 6 sections. The contents of these sections are summarized in Table 3-1.

TABLE 3-1

Table of Contents

Section	Title	Part of Section	Content
1	General	1.1	Introduction
		1.2	Interpretation of Test Results
		1.3	Concrete
		1.4	Types of Concrete
		1.5	Gypsum Wallboard
		1.6	Equivalent Thickness
		1.7	Contribution of Plaster or Gypsum Wallboard Finish to Fire Resistance of Masonry or Concrete
		1.8	Tests of Floors and Roofs
		1.9	Moisture Content
		1.10	Permeance and Durability
		1.11	Steel Structural Members
		1.12	Restraint Effects
2	Fire Resistance Ratings	2.1	Masonry and Concrete Walls
		2.2	Reinforced and Prestressed Concrete Floor and Roof Slabs
		2.3	Wood and Steel Framed Walls, Floors and Roofs
		2.4	Solid Wood Walls, Floors and Roofs
		2.5	Solid Plaster Partitions
		2.6	Protected Steel Columns
		2.7	Individually Protected Steel Beams
		2.8	Reinforced Concrete Columns
		2.9	Reinforced Concrete Beams
		2.10	Prestressed Concrete Beams
		2.11	Glue-Laminated Timber Beams and Columns
3	Flame-Spread Ratings and Smoke Developed Classifications	3.1	Interior Finish Materials
4	Noncombustibility	4.1	Test Method
		4.2	Materials Classified as Combustible
		4.3	Materials Classified as Noncombustible
5	Protection of Openings in Fire-Rated Assemblies	5.1	Scope
		5.2	Installation of Fire Doors and Fire Dampers
		5.3	Fire Stop Flaps
6	Background Information	6.1	Fire Test Reports
		6.2	Obsolete Materials and Assemblies
		6.3	Assessment of Archaic Assemblies
		6.4	Development of the Component Additive Method

3.2 OVERVIEW

EXERCISE #3-1

Review SB-2 and locate the Subsection(s) that covers the following material:

1. Minimum equivalent thickness for fire-resistance rating of masonry and concrete walls.

   ______________________________ [______________]

2. Fire-resistance rating of composite slabs comprised of reinforced or pre-stressed concrete.

   ______________________________ [______________]

3. Limitations of the 'component additive method' for wood and steel framed walls, floors and roofs.

   ______________________________ [______________]

4. Effect of addition of plaster to reinforced concrete columns.

   ______________________________ [______________]

5. Requirements for flame-spread ratings and smoke developed ratings.

   ______________________________ [______________]

6. Hold-open devices for firestop flaps.

   ______________________________ [______________]

STOP

3.3 GENERAL

The ratings found in SB-2 apply if more specific test values cannot be found [1.1.3.]. Additional information on fire rated assemblies, containing materials that cannot be found in a standard such as those found in Table 1.1.2, can be found at certification organizations accredited by the Standards Council of Canada. Subsection 1.1.5. provides some sources of this information.

The fire-resistance ratings for assemblies incorporating concrete are affected by the type of concrete, the aggregates in the concrete, its density and its thickness when used. Generally, low density aggregates exhibit better fire performance than natural stone or normal density concrete [1.3.1.].

If it is not possible to determine the nature of the concrete aggregate, the aggregate shall be considered to be in the group that requires that greater thickness of concrete for the required fire-resistance [1.4.2.].

3.4 EQUIVALENT THICKNESS

Read Subsection 1.6.1. and complete Exercise #3-2.

EXERCISE #3-2

1. For the masonry unit (concrete block) shown in Figure 3-1, calculate the equivalent thickness. Give SB-2 Sentence(s) used.

   ____

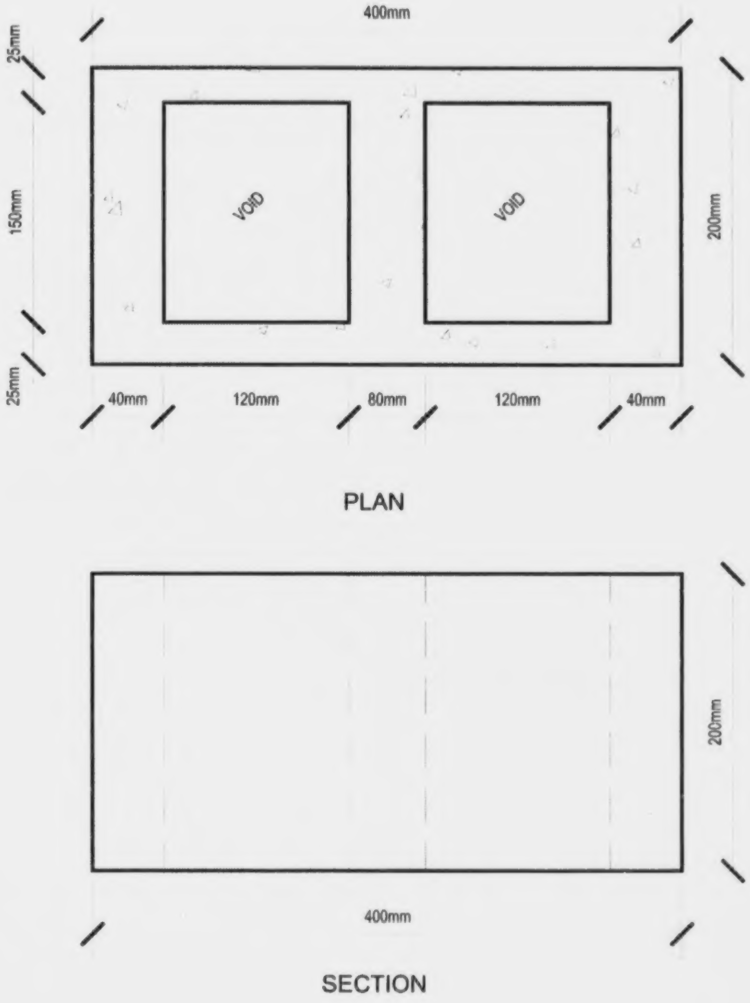
   ____

   ____

   ____________________[__________]

2. If a wall is constructed using the block described in 1., and has a 12 mm layer of portland cement-sand plaster finish added to each face, what is the equivalent thickness of the finished wall? Give SB-2 Sentence(s) used.

   ____________________[__________]


400mm
25mm
150mm
25mm
VOID
VOID
200mm
40mm
120mm
80mm
120mm
40mm
PLAN
200mm
400mm
SECTION

Note:

Use actual dimensions, not nominial dimensions.

FIGURE 3-1
Masonry Unit

3.5 FIRE-RESISTANCE RATINGS

3.5.1 Concrete/Masonry Walls

Fire-resistance of masonry and concrete walls is determined from Table 2.1.1. Ratings of up to 4 h are available. This applies to both loadbearing and non-loadbearing walls.

3.5.2 Concrete Floors

Fire-resistance of concrete floor and roof slabs is determined using Table 2.2.1.A for the minimum thickness of the slabs for various concrete types, and Table 2.2.1.B for the minimum concrete cover over the reinforcement in the slabs [2.2.1.(1), and 2.2.1.(2)].

3.5.3 Wood and Steel Framed Walls, Roofs and Floors

Read 2.3.1. to 2.3.4. of SB-2 and complete Exercise #3-3.

STOP

EXERCISE #3-3

Calculate the fire-resistance rating for the non-loadbearing wall assembly shown on the attached Figure 3-2. Give SB-2 references for your answer.

____

____________________________ [____________]

____

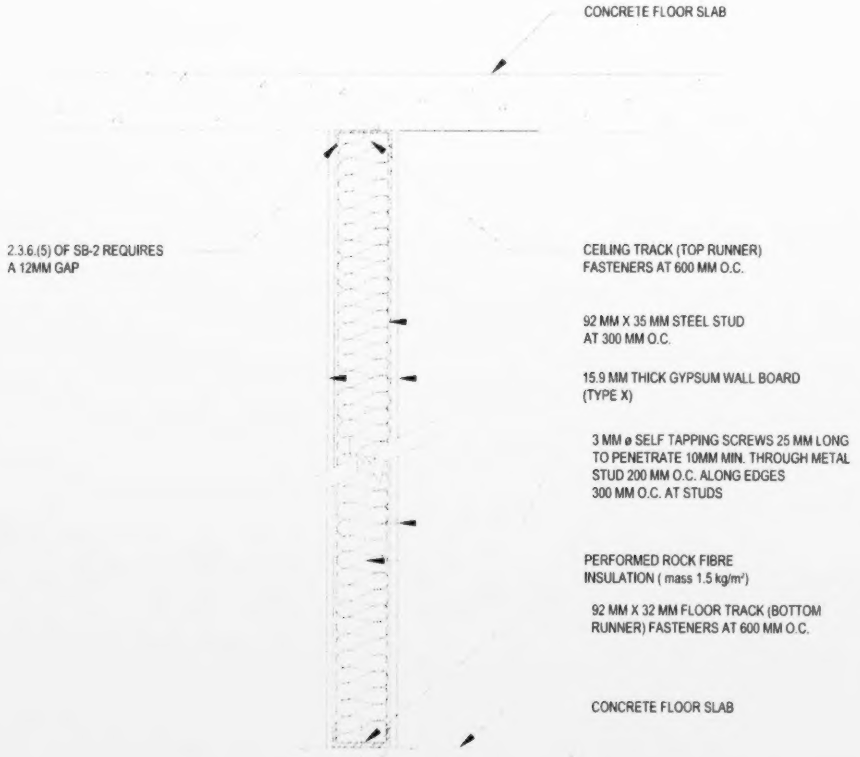
____________________________ [____________]

____

____________________________ [____________]

STOP

Fire-Resistance Rating, Interior Vertical Fire Separation



Fire-Resistance Rating, Interior Vertical Fire Separation
(non loadbearing)

CONCRETE FLOOR SLAB
2.3.6.(5) OF SB-2 REQUIRES A 12MM GAP
CEILING TRACK (TOP RUNNER) FASTENERS AT 600 MM O.C.
92 MM X 35 MM STEEL STUD AT 300 MM O.C.
15.9 MM THICK GYPSUM WALL BOARD (TYPE X)
3 MM ø SELF TAPPING SCREWS 25 MM LONG TO PENETRATE 10MM MIN. THROUGH METAL STUD 200 MM O.C. ALONG EDGES 300 MM O.C. AT STUDS
PERFORMED ROCK FIBRE INSULATION (mass 1.5 kg/m²)
92 MM X 32 MM FLOOR TRACK (BOTTOM RUNNER) FASTENERS AT 600 MM O.C.
CONCRETE FLOOR SLAB

FIGURE 3-2

The remainder of Subsection 2.3.5. provides additional guidance on wood and steel framed walls, floors and roofs.

Table 3-2 summarizes various sections of SB-2.

TABLE 3-2

Subsection (Sentence)	Guidance Provided
2.3.5. (1) (2) (3) (4)	no contribution for membrane on non-fire side of wall exterior wall insulation and exterior sheathing upper membrane of floor or roof assemblies attachment of insulation in wood floor assemblies
2.3.6.	Description of framing members
2.3.7.	Plaster finish thickness
2.3.8.	Edge support for attachment of gypsum wallboard
2.3.9.	Fastener spacing and length for plaster and gypsum wallboard
2.3.10.	Permitted openings in ceiling membranes of floors or roofs of combustible construction
2.3.11.	Permitted openings in ceiling membranes of floors or roofs of noncombustible construction
2.3.12.	Ratings for ceiling membranes only
2.3.13.	Beams in floor or roof assemblies
2.3.14.	Wired glass assemblies

STOP

3.5.4 Columns

Read 2.6.1. to 2.6.5. and complete Exercise #3-4.

EXERCISE #3-4

Calculate the mass/heated perimeter (M/D) ratio for the two steel columns shown in Figure 3-3 and determine their maximum fire-resistance rating, if they are protected with 38.1 mm of Type X gypsum wallboard, and installed in accordance with 2.6.5. The mass of column (a) is 22.4 kg/m and the mass of column (b) is 113 kg/m.

Give SB-2 references with your answers.

____

______________________________ [______________]

____

______________________________ [______________]

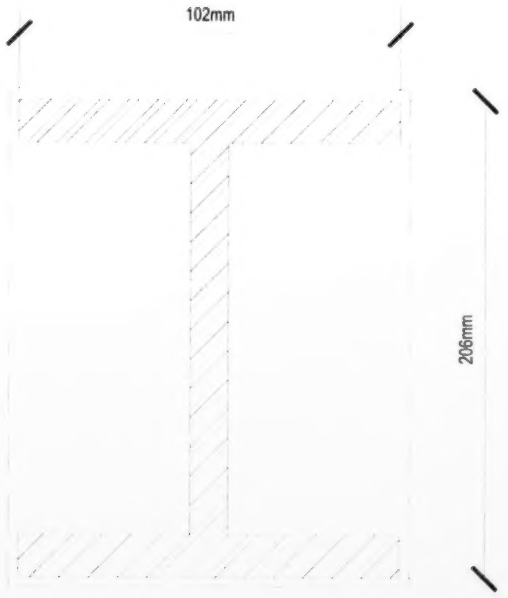

102mm
206mm

FIGURE 3-3 (a)

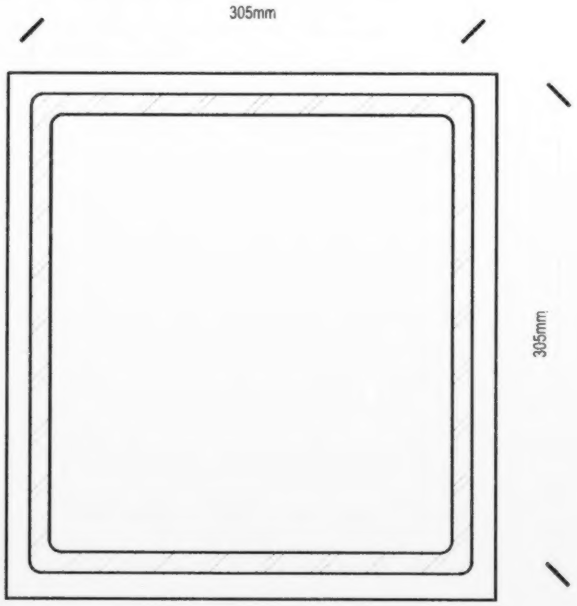

305mm
305mm

FIGURE 3-3 (b)

3.5.5 Beams

Fire-resistance ratings for individually protected steel beams can be found in 2.7 of SB-2. Ratings of 30 minutes to 4 h can be determined using Table 2.7.1.

The assumptions used in Table 2.7.1 are that fire exposure is from three sides, the bottom and the two sides and the top flange of the steel beam is not exposed to fire.

Ratings are assigned based on the material used to encase the steel beam, and the thickness of this material, referred to as 'minimum thickness of cover' in Table 2.7.1.

EXERCISE #3-5

For the following material types, and minimum thickness of application to a steel beam, determine the maximum fire-resistance rating. (Give SB-2 reference)

1. Cover comprised of gypsum-sand on metal lath with air gap between plaster and lower flange of steel beam, applied to a thickness of 16 mm.

   ______________________________ [______________]

2. Steel beam encased in Type N concrete (cast-in-place) such that the beam spaces are filled solid. The minimum thickness of cover is 39 mm.

   ______________________________ [______________]

3. What is the maximum fire-resistance rating for a steel beam protected by a membrane ceiling that contributes to the overall fire-resistance rating of the assembly, where the rating of the ceiling membrane is determined using Section 2.3 of SB-2.[See 2.3.3.(2) for limitations].

   ______________________________ [______________]

STOP

3.6 FLAME SPREAD RATINGS & SMOKE DEVELOPED CLASSIFICATIONS (Section 3) NONCOMBUSTIBILITY (Section 4) PROTECTION OF OPENINGS (Section 5)

Section 3 provides flame spread ratings and smoke developed classifications on materials that can be described generically and have an associated product standard.

The ratings are expressed as Y/YY

where Y is the flame spread rating and YY is the smoke developed classification (see 3.1.3.).

The ratings provided in Tables 3.1.1.A (wall and ceiling finishes) and Table 3.1.1.B (floor finishes) are maximum expected ratings corresponding to requirements found in Division B, Parts 3 and 9. Actual test results for these materials may be lower than the values given in these tables.

Section 4 provides examples of typical materials that are noncombustible when tested in accordance with CAN4-S114 "Test For Determination of Noncombustibility in Building Materials".

Section 5 provides guidance on the installation of fire doors and fire dampers in gypsum wallboard protected wood stud and steel stud framed walls.

Section 5 also provides a description of the ceiling firestop flap that must be used to protect openings in membrane ceilings described in Subsections 2.3.10. and 2.3.11. of SB-2.

EXERCISE #3-6

1. What is the flame spread rating of 6 mm thick Type 1 Standard hardboard? Give material Standard in your answer.

   ______________________ [______________]

2. What is the smoke developed classification of woven wool carpet, with a pile weight of 1500 g/m^2, applied without felt underlay? Give material Standard in your answer (include edition of Standard).

   ______________________ [______________]

STOP

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MODULE 4

LARGE BUILDINGS - 2006

BUILDING FIRE SAFETY - PART 1

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

4.1 INTRODUCTION

This module encompasses the first of three modules pertaining to Building Code Section 3.2. "Building Fire Safety". Module 4 is comprised of Subsection 3.2.1. "General" and Subsection 3.2.2. "Building Size and Construction Relative to Occupancy". The following provides summary information on each of these Subsections.

Subsection 3.2.1. "General"

Prior to determining the construction requirements of a building the building height must be assessed. The height of a building can significantly influence the construction requirements for the building. This includes items such as (but not limited to):

- required construction type (i.e. either combustible or noncombustible construction);
- provision of sprinkler protection;
- additional measures required for high buildings (not covered by this course, this is covered in the course entitled "Complex Buildings"); and
- structural fire-resistance ratings.

The height of a proposed building can be influenced by various design elements. These include, for example, the grade around the building, the presence of mezzanines and the use of rooftop mechanical spaces.

This Subsection also includes requirements regulating parking garages (storage garages), determination of whether a roof is considered a wall as well as ratings and containment of fire in basements. For the purpose of this module, only those additional requirements pertaining to storage garages will be addressed.

Subsection 3.2.2. "Building Size and Construction Relative to Occupancy"

The significance of this Subsection of the Building Code cannot be overstated. Construction classification underpins key principles of the Building Code concerning life safety, containment of smoke and fire and reduction of the probability of the collapse of a building from the effects of fire.

This portion of the module will focus on determination of the structural fire protection requirements for buildings. As noted above, these include regulations governing the construction type (i.e. combustible or noncombustible construction), requirements for provision of sprinkler protection and fire-resistance ratings of floor assemblies, mezzanines, roof assemblies and loadbearing walls, columns and arches.

Factors such as major occupancy classification, building height, and number of streets are important concepts from Subsection 3.2.1. which influence the construction classification of a building.

Objectives

Once you have completed this module, you will be able to:

- identify exceptions to building height
- identify requirements governing storage garages
- identify the effect of multiple major occupancies on construction classification
- explain the concept of "streets" and identify its effect on construction classification
- outline construction classification requirements for buildings
- outline requirements for construction of below grade storeys.

4.2 DEFINITIONS

The following terms from the Building Code, Division A, Part 1, Article 1.4.1.2., used in this module, are defined. The definitions provided below are for information purposes only. Reference should be made to the respective definition in the official volume of the Code.

Assembly occupancy

Assembly occupancy means the occupancy or the use of a building, or part of a building, by a gathering of persons for civic, political, travel, religious, social, educational, recreational or like purposes, or for the consumption of food or drink.

Basement

Basement means a storey or storeys of a building located below the first storey.

Building height

Building height means the number of storeys contained between the roof and the floor of the first storey.

Business and personal services occupancy

Business and personal services occupancy means the occupancy or use of a building or part of a building for the transaction of business or the rendering or receiving of professional or personal services.

Combustible

Combustible means that a material fails to meet the acceptance criteria of CAN4-S114, "Test for Determination of Non-combustibility in Building Materials".

Combustible construction

Combustible construction means that type of construction that does not meet the requirements for noncombustible construction.

Fire-resistance rating

Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria, or as determined by extension or interpretation of information derived from that test and performance as prescribed in this Code.

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Firewall

Firewall means a type of fire separation of noncombustible construction which subdivides a building or separates adjoining buildings to resist the spread of fire and which has a fire-resistance rating as prescribed in this Code and the structural stability to remain intact under fire conditions for the required fire-rated time.

First storey

First storey means the storey with its floor closest to grade and having its ceiling more than 1.8 m (5 ft 11 in) above grade.

Grade

Grade means the average level of proposed or finished ground adjoining a building at all exterior walls.

High hazard industrial occupancy

High hazard industrial occupancy (Group F, Division 1) means an industrial occupancy containing sufficient quantities of highly combustible and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

Industrial occupancy

Industrial occupancy means the occupancy or use of a building or part of a building for the assembling, fabricating, manufacturing, processing, repairing or storing of goods and materials.

Low hazard industrial occupancy

Low hazard industrial occupancy (Group F, Division 3) means an industrial occupancy in which the combustible content is not more than 50 kg/m^2 or 1200 MJ/m^2 of floor area.

Major occupancy

Major occupancy means the principal occupancy for which a building or part thereof is used or intended to be used, and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy.

Medium hazard industrial occupancy

Medium hazard industrial occupancy (Group F, Division 2) means an industrial occupancy in which the combustible content is more than 50 kg/m^2 or 1200 MJ/m^2 of floor area and not classified as high hazard industrial occupancy.

Mercantile occupancy

Mercantile occupancy means the occupancy or use of a building or part of a building for the displaying or selling of retail goods, wares or merchandise.

Mezzanine

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or storey and includes an interior balcony.

Noncombustible

Noncombustible means that a material meets the acceptance criteria of CAN4-S114, "Standard Method of Test for Determination of Non-combustibility in Building Materials".

Noncombustible construction

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Occupancy
Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Residential occupancy
Residential occupancy means the occupancy or use of a building or part of a building by persons for whom sleeping accommodation is provided but who are not harboured or detained there to receive medical care or treatment or who are not involuntarily detained there.

Service room
Service room means a room provided in a building to contain equipment associated with building services.

Service space
Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Sprinklered
Sprinklered means equipped with a system of automatic sprinklers.

Storage garage
Storage garage means a building or part of a building intended for the storage or parking of motor vehicles and which contains no provision for the repair or servicing of such vehicles.

Storey
Storey means that portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

Street
Street means any highway, road, boulevard, square or other improved thoroughfare 9 m or more in width, which has been dedicated or deeded for public use, and is accessible to fire department vehicles and equipment.

Suite

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for business and personal services occupancies. Additional explanatory material is available in the Building Code Appendix A-1.4.1.2.

Tenancy in the context of the term 'suite' applies to both rental and ownership tenure. In a condominium, for example, dwelling units are considered separate suites. The term suite is not applied to service rooms, common laundry rooms and common recreational rooms that are not leased or under a separate tenure. Similarly, the term suite is not normally applied in schools and hospitals, since the entire building is under a single tenure. A rented room in a home for the aged could be considered a suite if the room were under a separate tenure. A hospital bedroom is not considered to be under a separate tenure, since the patient has little control of that space, even though the hospital is paid a per diem rate for the privilege of using the hospital facilities, which include the sleeping areas. In a hospital, while groups of rooms may function as a unit (e.g. maternity wards or intensive care units), they are not suites, since they are not under separate management or control.

STOP

4.3 EXCEPTIONS IN DETERMINING BUILDING HEIGHT

"Building height" is a defined term meaning "... the number of storeys contained between the roof and the floor of the first storey".

The determination of what constitutes the "first storey" is influenced by the "grade" around the perimeter of the building. Consider the following definitions:

First storey: The storey with its floor closest to grade and having its ceiling more than 1.8 m above grade.

Grade: The average level of proposed finished ground adjoining a building at all exterior walls.

Article 3.2.1.1. "Exceptions in Determining Building Height" identifies configurations by which "building height" is influenced. This includes the presence of elements such as mezzanines, mechanical rooftop enclosures, services spaces, elevated walkways and platforms.

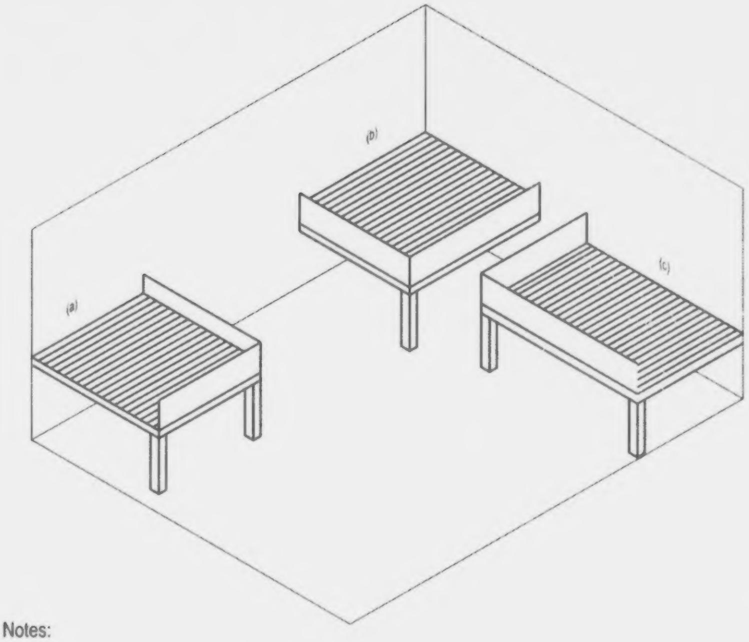
Table 4-1 consolidates the conditions wherein the noted element (i.e. service space, mezzanine) need not be considered as a storey in determining the building height.

TABLE 4-1

Exceptions in Determining Building Height			
Element	Criteria for Exemption as a Storey	Code Reference	Notes
Rooftop Enclosure	1. Contains either elevator machinery, stairway or service room used for no other purpose than servicing the building.	Sentence 3.2.1.1.(1)	N/A
Space below seating tiers	1. Arena type buildings only, provided the space is used only for dressing rooms, concession stands and similar purposes incidental to the major occupancy of the building.	Sentence 3.2.1.1.(2)	- See Figure 4-2
40% (Open) Mezzanine	1. Aggregate area of the mezzanine floor is not greater than 40% of the area of the room or storey in which it is located, it is used as an open floor area (1) and visual obstructions greater than 1070 mm above the mezzanine floor are not permitted.	Sentence 3.2.1.1.(3)	(1) Except in libraries, subject to meeting the requirements of Sentence 3.3.2.11.(3). (2) Except an open mezzanine of 10% enclosed area provided visual communication is maintained 3.2.1.1.(8) - See Figures 4-5, 4-6, and 4-7
10% (Enclosed) Mezzanine	1. Aggregate area of the mezzanine floor is not greater than 10% of the suite or storey in which it is located.	Sentence 3.2.1.1.(4)	- Appendix A-3.2.1.1.(3) - See Figures 4-3 and 4-4
Multiple Mezzanines	1. If one or more mezzanines are positioned above another, in whole or in part, each subsequent level to the first mezzanine level is considered as a storey.	Sentence 3.2.1.1.(5)	- See Figure 4-8 - except as permitted by 3.2.1.1.(6) & (7)

Exceptions in Determining Building Height			
Platforms intended solely for periodic inspection and elevated catwalks	1. They are not used for storage. 2. Noncombustible construction unless the building is permitted to be of combustible construction. 3. If they are intended to be occupied, the occupant load must not exceed 4 persons.	3.2.1.1.(6)	N/A
Mezzanines, walkways, platforms in Group F, Division 2 or 3 major occupancies	1. The building must be of noncombustible construction. 2. If they are intended to be occupied, the occupant load must not exceed 4 persons.	Sentence 3.2.1.1.(7)	N/A
Service Spaces	1. Services spaces for building services are exempted provided they conform with: a. Articles 3.2.5.15. and 3.3.1.23. b. Sentences 3.2.4.19.(12), 3.2.7.3.(2), 3.3.1.3.(7), 3.4.2.4.(3) and 3.4.4.4.(9).	Sentence 3.2.1.1.(9)	- Appendix A-3.2.1.1.(9)

STOP



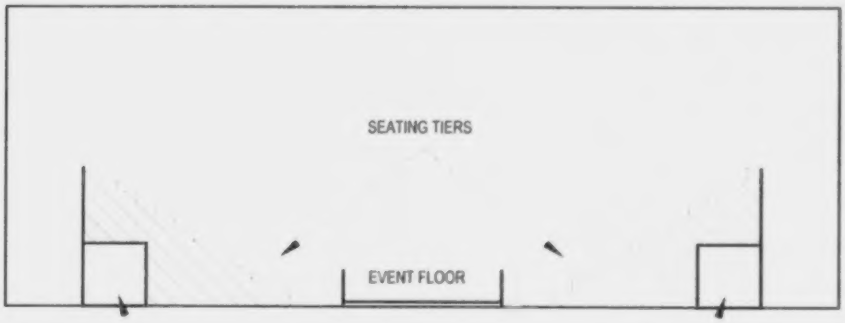
Notes:

1. Aggregate area= (a)+(b)+(c) of mezzanine.

2. Expressed as a % of:

a) the open area of the room in which it is located (Clause 3.2.1.1.(3)(a)) for 40% (open) mezzanine, or
b) the floor area in which it is located (Clause 3.2.1.1.(4)(a)) for 10% (enclosed) mezzanine, and the suite in which it is located (Clause 3.2.1.1.(4)(b)) for 10% (enclosed) mezzanine.

FIGURE 4-1



Sentences 3.2.1.1.(2)
Space below seating tiers exempted from classification as a storey provided space is used for only:
-Dressing rooms
-Concession stands
-Similar purposes incidental to major occupancy of the building.

FIGURE 4-2

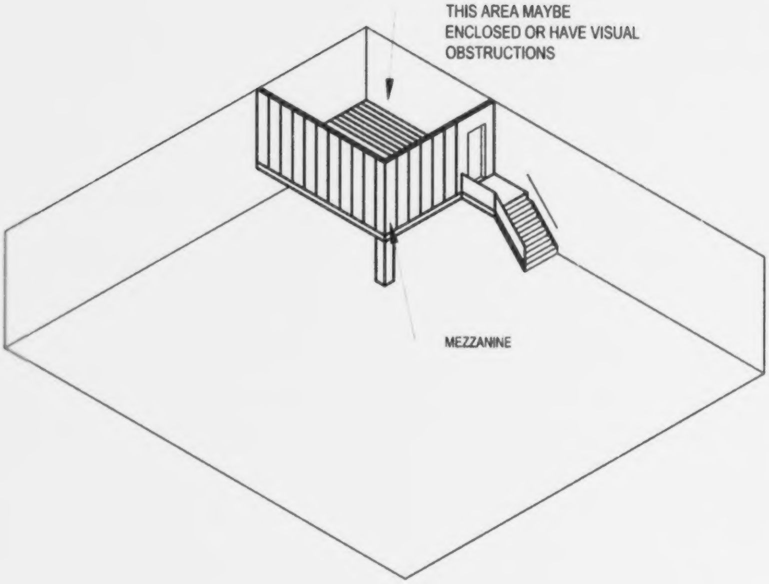
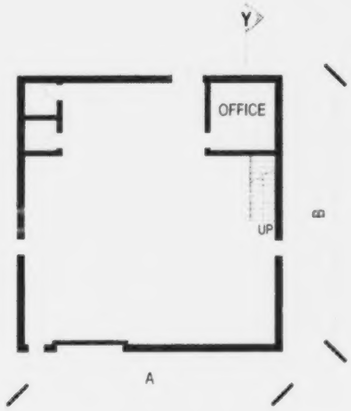
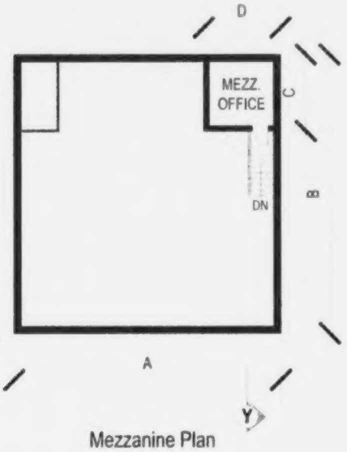

THIS AREA MAYBE ENCLOSED OR HAVE VISUAL OBSTRUCTIONS
MEZZANINE

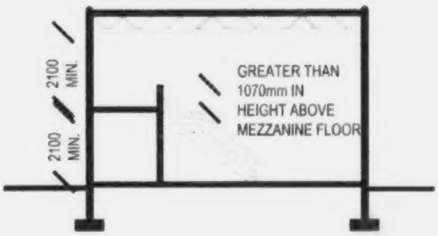
FIGURE 4-3


Y
OFFICE
UP
B
A

1st Storey Floor Plan


D
MEZZ.
OFFICE
C
DN
B
A
Y

Mezzanine Plan


2100
MIN.
2100
MIN.
GREATER THAN
1070mm IN
HEIGHT ABOVE
MEZZANINE FLOOR

Section Y-Y

Notes:

1. $C \times D < 0.10 (A \times B)$
2. Up to 10% of the suite, if there is more than one suite in the storey; up to 10% of the storey, in all other cases.
3. If conditions are not met this creates a second storey.

FIGURE 4-4

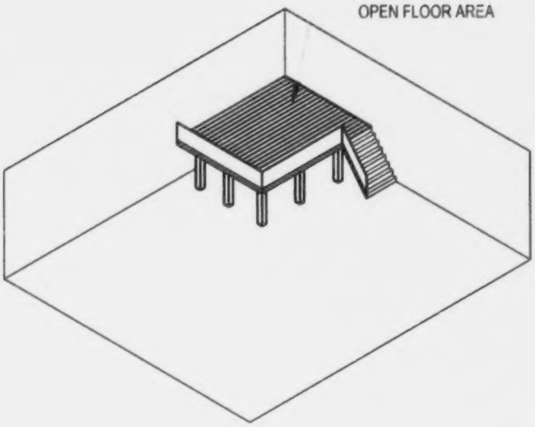
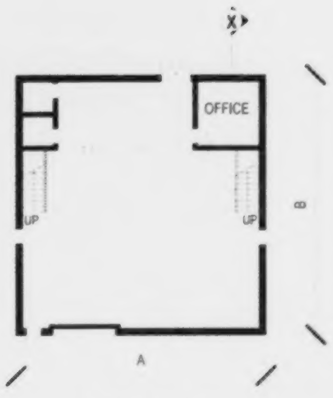
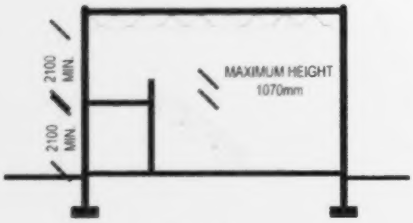

OPEN FLOOR AREA

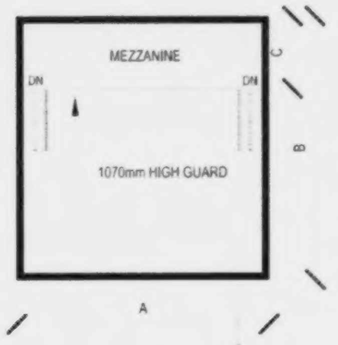
FIGURE 4-5


X
OFFICE
UP
UP
B
A

1st Storey Floor Plan


2100 MIN
2100 MIN
MAXIMUM HEIGHT 1070mm

Section X-X

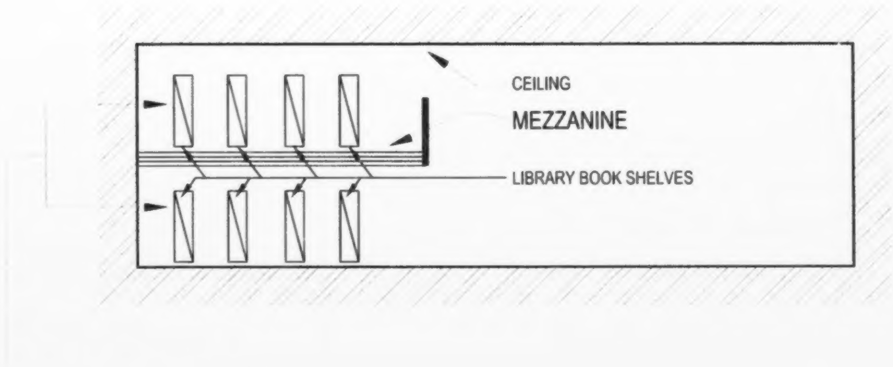

MEZZANINE
DN
DN
C
B
1070mm HIGH GUARD
A
X

Mezzanine Plan

Notes:

1. A x C < 0.4(A x B)
2. Used as an open floor area.
3. Visual obstructions higher than 1070mm above mezzanine floor are not permitted except in libraries as permitted by Sentence 3.3.2.11.(3) or where the enclosed space is greater than 10% of the open area of the room in which it is located in accordance with 3.2.1.1.(8).
4. Up to 40% of the area of the "room or suite" (Clause 3.2.1.1.(3)(a)).
5. If conditions are not met this creates a second storey.

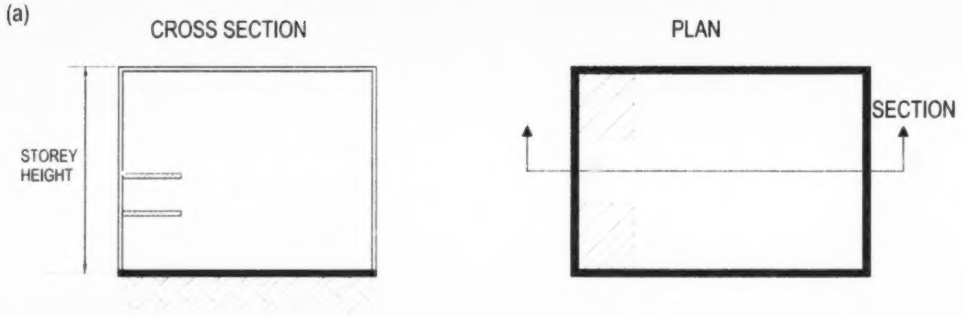
FIGURE 4-6


CEILING
MEZZANINE
LIBRARY BOOK SHELVES

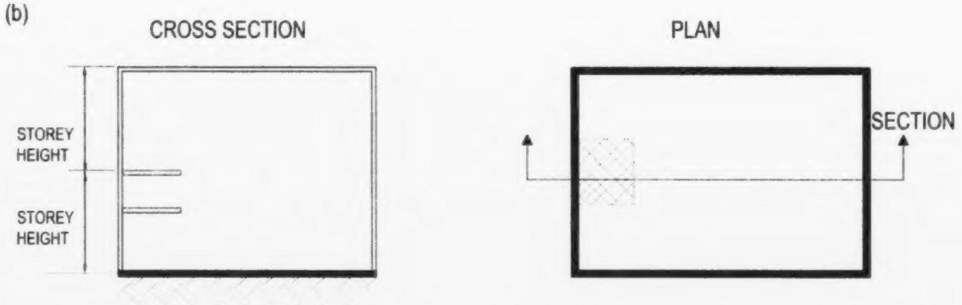
Maximum Height of Bookshelves:

Up to 2100 mm and not more than 75% of the floor-to-ceiling height above or below the mezzanine.

FIGURE 4-7


(a)
CROSS SECTION
STOREY HEIGHT
PLAN
SECTION

Multiple mezzanines must be considered as storeys if they are located above one another, either in whole or in part (Sentence 3.2.1.1.(5)).


(b)
CROSS SECTION
STOREY HEIGHT
STOREY HEIGHT
PLAN
SECTION

The mezzanines shown above are partially superimposed. Therefore, the mezzanine level above the first mezzanine is considered a storey.

FIGURE 4-8

EXERCISE #4-1

1. Select the correct condition under which visual obstructions above 1,070 mm in height are permitted on a 40% (open) mezzanine.

   a) 40% (open) mezzanine, Group D office occupancy with filing cabinets at 1,080 mm above the mezzanine floor.

   b) 40% (open) mezzanine, Group A, Division 1 occupancy with viewing screen at 2,100 mm in height above the mezzanine floor.

   c) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,000 mm above the mezzanine floor and 80% of the floor-to-ceiling height of the space above the floor assembly.

   d) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,100 mm above the floor of the mezzanine and 70% of the floor-to-ceiling height of the space above the mezzanine floor assembly.

   ____

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   ____

   ______________________________ [______________]

2. Are visual obstructions exceeding 1070 mm above the floor of a mezzanine that is 33% of the storey in which it is located, always prohibited? If not, provide support, with Code references, for your answer.

   ____

   ____

   ____

   ____

   ____________________________ [______________]

3. Review Figure 4-9. Does the mezzanine satisfy the requirement(s) for exemption as a storey? Provide support, with Code references, for your answer.

   ____

   ____

   ____

   ____________________________ [______________]

4. In a building of Group C (residential) major occupancy, a laundry room for the use of building occupants is located within the rooftop enclosure. The laundry room comprises 15% of the area of the rooftop enclosure. Must the rooftop enclosure be considered as a storey? Select the most correct answer from the options below.

   a) No, this rooftop occupancy is not required to be considered as a storey.

   b) Yes, the rooftop laundry room must be considered as a storey because it comprises more than 10% of the area of the roof on which it is located.

   c) Yes, the rooftop laundry room must be considered as a storey as it is not a service room.

d) No, this rooftop enclosure is not required to be considered as a storey because it is only for building occupants.

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____

_________________________[____________]

5. Review Figure 4-10 and select the most correct answer.

a) Each mezzanine must be considered as a storey. Therefore, the mezzanines contribute 3 additional storeys.

b) The mezzanines are open and therefore do not contribute any additional storeys.

c) Since mezzanines B and C are located at different heights from the floor, one additional storey must be added to the building height.

d) Mezzanines A and B are superimposed. Therefore, mezzanine A must be considered as a storey.

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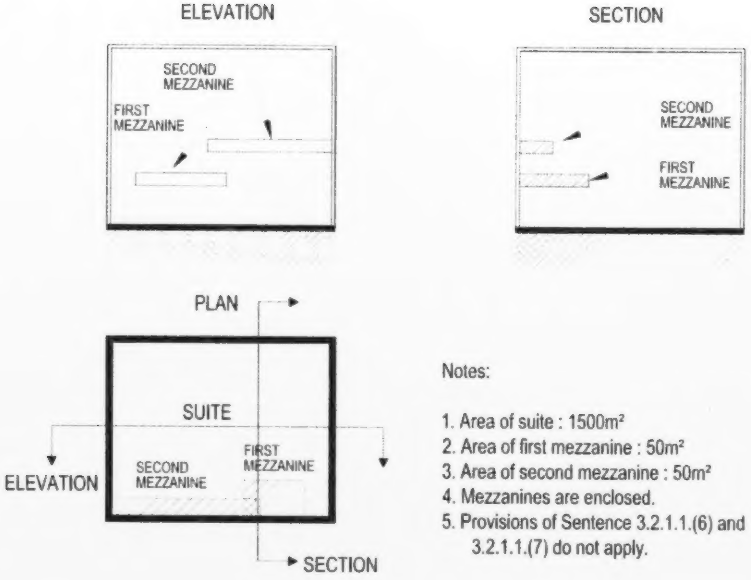
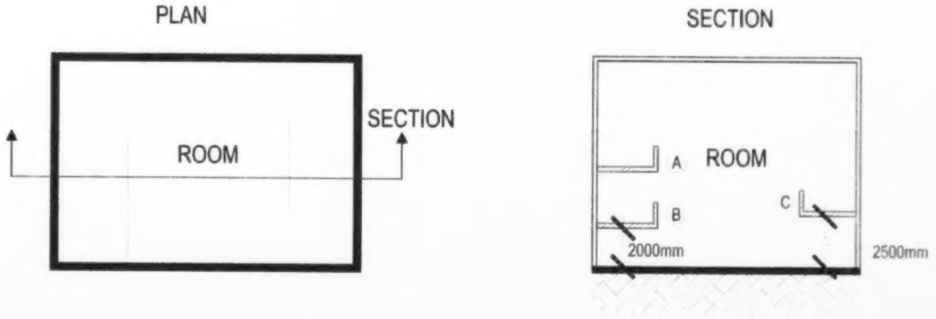
STOP


ELEVATION
SECOND MEZZANINE
FIRST MEZZANINE
SECTION
SECOND MEZZANINE
FIRST MEZZANINE
PLAN
SUITE
ELEVATION
SECOND MEZZANINE
FIRST MEZZANINE
SECTION

Notes:

1. Area of suite : 1500m^2
2. Area of first mezzanine : 50m^2
3. Area of second mezzanine : 50m^2
4. Mezzanines are enclosed.
5. Provisions of Sentence 3.2.1.1.(6) and 3.2.1.1.(7) do not apply.

FIGURE 4-9


PLAN
ROOM
SECTION
SECTION
A
ROOM
B
C
2000mm
2500mm

Notes:

1. Mezzanine A 14% of area of the room.
2. Mezzanine B 14% of the area of the room.
3. Mezzanine C 11% of the area of the room
4. All mezzanines are open (i.e. no visual obstruction above 1070mm from the mezzanine floor).

FIGURE 4-10

4.4 STORAGE GARAGE CONSIDERED AS A SEPARATE BUILDING

Article 3.2.1.2. regulates requirements which permit a storage garage to be considered as a separate building. Review Figure 4-11.

EXERCISE #4-2

1. Referring only to Sentence 3.2.1.2.(1), identify the criteria which would permit consideration of a storage garage as a separate building? Provide a code reference with your answer.

____

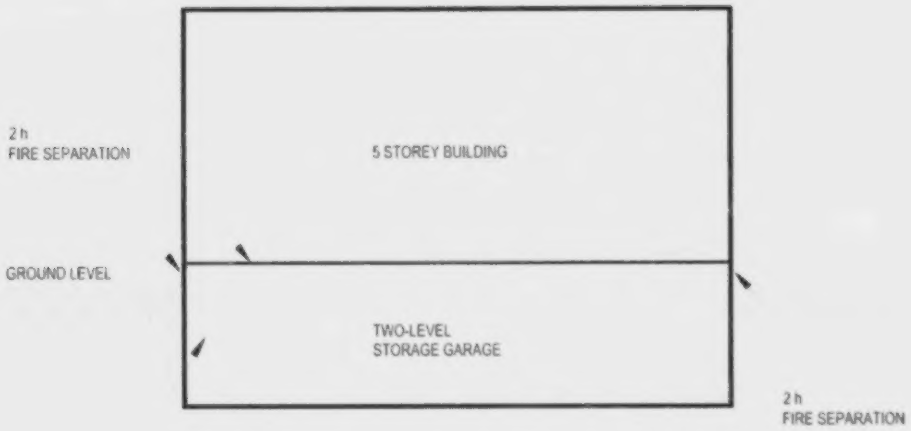
____

____

____

______________________________ [______________]

STOP


2 h
FIRE SEPARATION
5 STOREY BUILDING
GROUND LEVEL
TWO-LEVEL
STORAGE GARAGE
2 h
FIRE SEPARATION

Notes:

1. Fire separations must be constructed of solid masonry or concrete.
2. Provisions of Sentences 3.2.1.2.(2) and 3.2.1.2.(3) may also apply.

FIGURE 4-11

4.5 BUILDING SIZE AND CONSTRUCTION RELATIVE TO OCCUPANCY

Subsection 3.2.2. establishes the primary construction requirements for buildings. This includes determination of permitted construction type (i.e. combustible or noncombustible) and fire-resistance ratings of assemblies and their structural supports.

The purpose of the requirements contained within this Subsection of the Building Code is to provide life safety and property protection by preventing fire spread and reducing the probability of collapse due to the effects of fire.

Overall protection against the spread of fire and building collapse caused by fire is achieved through:

- Use of noncombustible construction materials.
- Fire separation between floors.
- Compartmentalization of floor areas.
- Provision of automatic sprinkler protection.
- Fire department access.
- Increased requirements for fire-resistance ratings commensurate with increased building area and building height.

The construction classification of a building is influenced by a number of characteristics. These include:

- Major occupancy classification,
- Multiple and superimposed major occupancies,
- Number of facing streets,
- Building height, and
- Building area.

This portion of the module will focus on providing a general understanding of how to determine appropriate construction classification for a building. This will incorporate consideration for other key concepts such as those listed above.

Objectives

- Identify building height and building area.
- Determine the effect of multiple and superimposed major occupancies on construction classification.
- Identify the number of streets that serve a building.
- Determine structural fire-resistance ratings for storeys below ground.
- Understand the process of selecting the appropriate construction classification.

STOP

4.6 OVERVIEW OF SUBSECTION 3.2.2., "BUILDING SIZE AND CONSTRUCTION RELATIVE TO OCCUPANCY"

Subsection 3.2.2. comprises two general components. First, this Subsection describes the application of the requirements contained therein and specific rules/ exemptions that apply in certain circumstances. These are contained in Articles 3.2.2.2. through Article 3.2.2.19. (Article 3.2.2.1. is applicable to all buildings).

A summary of these Articles is provided in Table 4-2. This table provides only summary information on the respective regulations and should not be used for the purposes of Building Code application or interpretation.

The second component of Subsection 3.2.2. contains construction classification requirements. A summary of the construction classification size limits, per major occupancy, is provided in Table 4-3. These requirements set out the parameters for a building's construction type and structural fire-resistance requirements.

The determination of such requirements is based on the major occupancy classification of the building and is influenced by factors such as those summarized in Table 4-2.

Requirements pertaining to the effect of multiple and superimposed major occupancies will be addressed in additional detail in the subsequent segments of this module.

TABLE 4-2

ARTICLES 3.2.2.2. THROUGH 3.2.2.19		
Article	Title	Description
3.2.2.2.	Special and Unusual Structures	Addresses buildings which cannot be categorized in a building classification within Articles 3.2.2.20. to 3.2.2.83.
3.2.2.3.	Exceptions to Structural Fire Protection	Identifies structural members which are exempted from requiring fire protection.
3.2.2.4.	Buildings with Multiple Major Occupancies	States that building height and area are applied in determining construction requirements. If multiple major occupancies are present, this Article mandates the application of Articles 3.2.2.5. through 3.2.2.8.
3.2.2.5.	Applicable Building Height and Area	For a building containing multiple major occupancies, the building height and building area of the entire building must be applied.
3.2.2.6.	Multiple Major Occupancies	Except for "superimposed" major occupancies (and those waived in Article 3.2.2.8.) the most conservative construction classification requirements must be applied when a building contains multiple major occupancies.
3.2.2.7.	Superimposed Major Occupancies	The construction classification of each major occupancy must be assessed as though the entire building were of that occupancy (except those waived in Article 3.2.2.8.) The fire-resistance rating required for the floor separating superimposed major occupancies is based on the ratings required for the lower major occupancy.
3.2.2.8.	Exceptions for Major Occupancies	- Major occupancy designation is waived if the total area of the occupancy within a floor area of the storey is not more than10%. - The exception does not apply to Group F, division 1 or 2 occupancies. - Roof-top helicopter landing pads are not considered major occupancies provided they do not exceed 10% of the area of the roof.
3.2.2.9.	Crawl Spaces	Regulates crawl spaces relative to whether they must be considered as basements.

ARTICLES 3.2.2.2. THROUGH 3.2.2.19		
3.2.2.10.	Streets	Identifies the criteria for determining the number of streets serving a building.
3.2.2.11.	Exterior Balconies	Exterior balconies must be of the same construction type as required for the occupancy classification of the building.
3.2.2.12.	Exterior Passageways	Elevated exterior passageways forming part of the means of egress must meet the construction requirements for mezzanines.
3.2.2.13.	Occupancy of Roof	The portion of a roof supporting an occupancy must be constructed with the same fire separation requirements for floor assemblies required in Articles 3.2.2.20 to 3.2.2.83.
3.2.2.14.	Roof-Top Enclosures	Regulates the type of construction of roof-top enclosures.
3.2.2.15.	Storeys below Ground	Regulates the fire-resistance ratings required for floor assemblies forming part of storeys below grade.
3.2.2.16.	Heavy Timber Roof Permitted	Provides permission for use of heavy timber construction for a roof, under certain circumstances.
3.2.2.17.	Sprinklers in Lieu of Roof Rating	Permits the waiver of roof rating requirements of Articles 3.2.2.20. through 3.2.2.83. provided the criteria of Sentence 3.2.2.17.(1) are met.
3.2.2.18.	Automatic Sprinkler System Required	Sprinkler systems required by Articles 3.2.2.20. though 3.2.283. must meet the requirements of Articles 3.2.4.7. through 3.2.4.9. and Article 3.2.5.13.
3.2.2.19.	Buildings Containing Impeded Egress Zones	Permits the waiver of Articles 3.2.2.36 and 3.2.2.37 for buildings containing impeded egress zones under specific conditions.

The following Table 4-3 provides summary information on the general organization of the construction classification requirements.

TABLE 4-3

FORMAT OF ARTICLES 3.2.2.20. THROUGH 3.2.2.83.

Size	Building Type	Reference	Size Limits
Large	Group A, Division 1	3.2.2.20.	Any height, any area, sprinklered
↓		3.2.2.21.	1 storey, limited area
Smaller		3.2.2.22.	1 storey
Large	Group A, Division 2	3.2.2.23.	Any height, any area, sprinklered
		3.2.2.24.	up to 6 storeys, any area, sprinklered
↓		3.2.2.25.	Up to 2 storeys
		3.2.2.26.	up to 2 storeys, increased area, sprinklered
Smaller		3.2.2.27.	up to 2 storeys, sprinklered
		3.2.2.28.	1 storey
Large	Group A, Division 3	3.2.2.29.	Any height, any area (if under Subsection 3.2.6., sprinklered)
		3.2.2.30.	Up to 2 storeys
		3.2.2.31.	Up to 2 storeys, sprinklered
↓		3.2.2.32.	1 storey, increased area
		3.2.2.33.	1 storey, sprinklered
		3.2.2.34.	1 storey
Smaller	Group A, Division 4	3.2.2.35.	1 storey - all buildings, sprinklered in all spaces below seats used for occupancy
Large	Group B, Division 1	3.2.2.36.	Any height, any area, sprinklered
		3.2.2.37.	Up to 3 storeys, sprinklered
↓	Group B, Division 2	3.2.2.38.	Any height, any area, sprinklered
	Group B, Division 3	3.2.2.39.	Up to 3 storeys, sprinklered
		3.2.2.40.	Up to 2 storeys, sprinklered
Smaller		3.2.2.41.	One storey, sprinklered
Large	Group C	3.2.2.42.	Any height, any area
		3.2.2.43.	Up to 6 storeys
		3.2.2.44.	(Reserved)
↓		3.2.2.45.	Up to 4 storeys, sprinklered
		3.2.2.46.	Up to 3 storeys, increased area
		3.2.2.47.	Up to 3 storeys
Smaller		3.2.2.48.	Up to 3 storeys, sprinklered

Large	Group D	3.2.2.49.	Any height, any area (if under Subsection 3.2.6., sprinklered)
↓		3.2.2.50.	Up to 6 storeys
		3.2.2.51.	Up to 6 storeys, sprinklered
		3.2.2.52.	Up to 4 storeys, sprinklered
		3.2.2.53.	Up to 3 storeys
		3.2.2.54.	Up to 3 storeys, sprinklered
		3.2.2.55.	Up to 2 storeys
Smaller		3.2.2.56.	Up to 2 storeys, sprinklered
Large	Group E	3.2.2.57.	Any height, any area, sprinklered
↓		3.2.2.58.	Up to 4 storeys, sprinklered
		3.2.2.59.	Up to 3 storeys
		3.2.2.60.	Up to 3 storeys, sprinklered
		3.2.2.61.	Up to 2 storeys
Smaller		3.2.2.62.	Up to 2 storeys, sprinklered
Large	Group F, Division 1	3.2.2.63.	Up to 4 storeys, sprinklered
↓		3.2.2.64.	Up to 3 storeys, sprinklered
		3.2.2.65.	Up to 2 storeys, sprinklered
Smaller		3.2.2.66.	1 storey
Large	Group F, Division 2	3.2.2.67.	Any height, any area, sprinklered
↓		3.2.2.68.	Up to 6 storeys
		3.2.2.69.	Up to 4 storeys, increased area
		3.2.2.70.	Up to 4 storeys
		3.2.2.71.	Up to 2 storeys
Smaller		3.2.2.72.	Up to 2 storeys, sprinklered
Large	Group F, Division 3	3.2.2.73.	Any height, any area (if under Subsection 3.2.6., sprinklered)
↓		3.2.2.74.	Up to 6 storeys
		3.2.2.75.	Up to 6 storeys, sprinklered
		3.2.2.76.	Up to 4 storeys
		3.2.2.77.	Up to 4 storeys, sprinklered
		3.2.2.78.	Up to 2 storeys
		3.2.2.79	Up to 2 storeys, sprinklered
		3.2.2.80.	1 storey
		3.2.2.81.	1 storey, sprinklered
		3.2.2.82.	1 storey, any area, low fire load
Smaller		3.2.2.83.	Storage garages, up to 22 m high

STOP

EXERCISE #4-3

Using the information provided in Tables 4-2 and 4-3 in combination with reference to the Building Code, as applicable, answer the following questions.

1. If a building contains more than one major occupancy (and these major occupancies are not superimposed, however, are more than 10% of the floor area), which requirements are applied in determining the construction classification of the building? Provide a Code reference with your answer.

   ____

   ____________________________ [______________]

2. Consider Figure 4-12. Identify the number of streets the building faces. Include a Code reference to support your decision.

   a) 1 street
   b) 2 streets
   c) 3 streets
   d) 4 streets

   ____

   ____

   ____

   ____

   ____________________________ [______________]

3. A shopping mall contains 3 storeys below grade. The below grade storeys contain retail (Group E) occupancies. Identify the most appropriate fire-resistance rating criteria for the floor assemblies below the ground floor. Provide Code references with your answer.

   a) The below grade floor assemblies must have a fire-resistance rating of 2 h.

   b) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h.

   c) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h if the building is sprinklered.

   d) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 3 h.

   ____

   ____

   ____

   ____

   __________________ [__________]

4. Provide the Code reference and the primary criteria used in determining whether the fire-resistance rating of a roof is permitted to be waived.

   ____

   ____

   ____

   __________________ [__________]

5. Identify the criteria which require an occupancy to be considered as a major occupancy relative to the application of Articles 3.2.2.20. through 3.2.2.83.

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___________________________[____________]

STOP

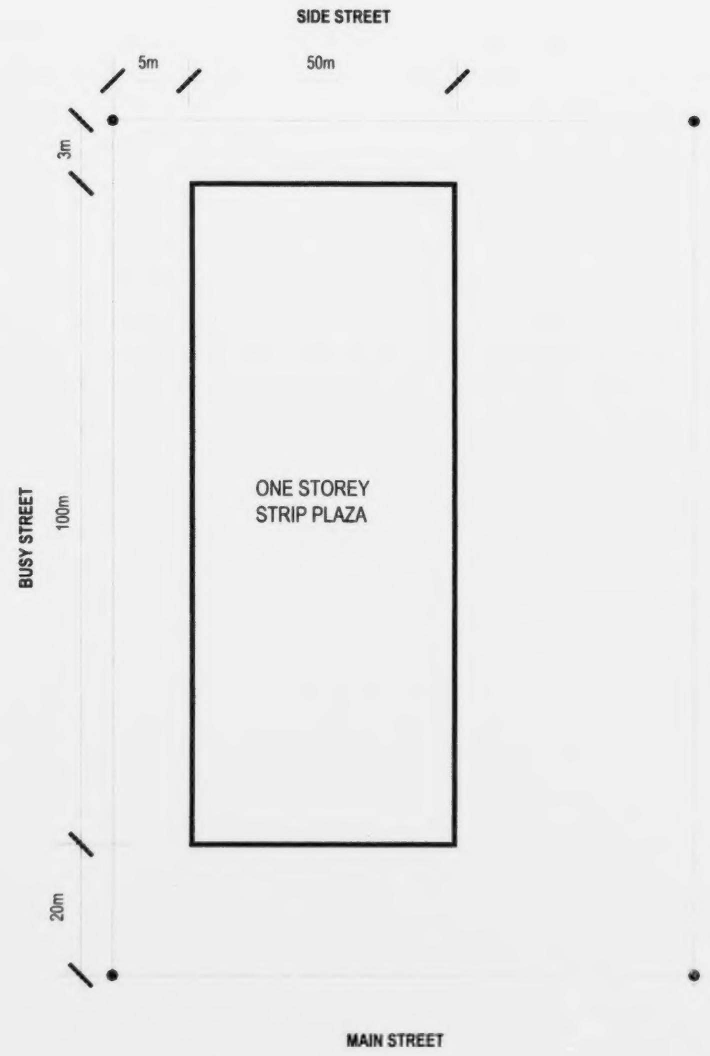

SIDE STREET
5m
50m
3m
BUSY STREET
100m
ONE STOREY
STRIP PLAZA
20m
MAIN STREET

FIGURE 4-12

4.7 DETERMINING CONSTRUCTION CLASSIFICATION

Articles 3.2.2.20. through 3.2.2.83 contain construction classification requirements based on major occupancy classification. This component of the module will address:

- Determination of the appropriate construction classification for buildings containing single major occupancies.
- Determination of the appropriate construction classification for buildings containing multiple major occupancies, including superimposed major occupancies.
- Description of the distinction between primary construction types.

The process of determining the construction classification of a building has four steps. This can best be summarized as noted in Table 4-4.

TABLE 4-4

DETERMINATION OF CONSTRUCTION CLASSIFICATION			
Step	Action	Description	Considerations
1	Review preliminary building information	Determine from drawings (or other information provided): 1. Major occupancy classification(s) 2. Building height 3. Building area 4. Provision of sprinkler protection 5. Number of streets	1. Apply the requirements of Articles 3.2.2.4. through 3.2.2.8. as necessary for multiple occupancies. See Tables 4-5, 4-6 for additional information. 2. Grade level around the building; determination of the location of the first storey 3. Presence of firewalls, i.e. as it affects building area.
2	Determine construction classification	Based on the information obtained in Step #1, select the appropriate construction classification from Articles 3.2.2.20. through 3.2.2.83.	1. Consider the impact of multiple major occupancies. See Tables 4-5, 4-6.
3	List construction requirements	Contained within Articles 3.2.2.20. through 3.2.2.83. Sentence (2) of each Article will contain the applicable construction classification requirements. **Attention:** construction requirements within an Article may be dependent upon multiple factors (i.e. building height, building area, number of streets).	1. Subsequent Sentences may be provided, in addition to Sentence (2), which contain requirements applicable to the building. If provided, these Sentences must be applied, as appropriate, to the respective building.
4	Consider exceptions and special conditions	Apply Articles 3.2.2.2., 3.2.2.3., and 3.2.2.9. through 3.2.2.19. As appropriate.	1. Articles 3.2.2.4. through 3.2.2.8. should be reviewed as part of Step #1.

The presence of multiple major occupancies requires the consideration of Articles 3.2.2.4. through 3.2.2.8. These requirements, if applicable, can influence overall construction requirements. Tables 4-5 and 4-6 provide information and general application guidelines relative to these Articles.

TABLE 4-5

MULTIPLE MAJOR OCCUPANCIES		
Reference	Summary	Considerations
Article 3.2.2.4.	Building height and building area must be applied. Where multiple occupancies are present, apply Article 3.2.2.5. through 3.2.2.8.	Determine whether the major occupancies are exempted from Articles 3.2.2.5. through 3.2.2.7. by Article 3.2.2.8.
Article 3.2.2.5.	The building height and building area must be applied to each major occupancy.	Remember that building height and building area are defined terms.
Article 3.2.2.6.	In buildings containing more than one major occupancy, the construction requirements of the most restrictive major occupancy must be applied.	See Figure 4-13 Determine whether the building contains superimposed major occupancies. If it does, Article 3.2.2.7. is applicable.
Article 3.2.2.7*	Applies to major occupancies located above each other. The floor assembly rating between the major occupancies is based on the lower major occupancy.	See Figure 4-14
Article 3.2.2.8.	Details criteria for exemption of major occupancies from the requirements of Articles 3.2.2.4. through 3.2.2.7.	See Figure 4-15

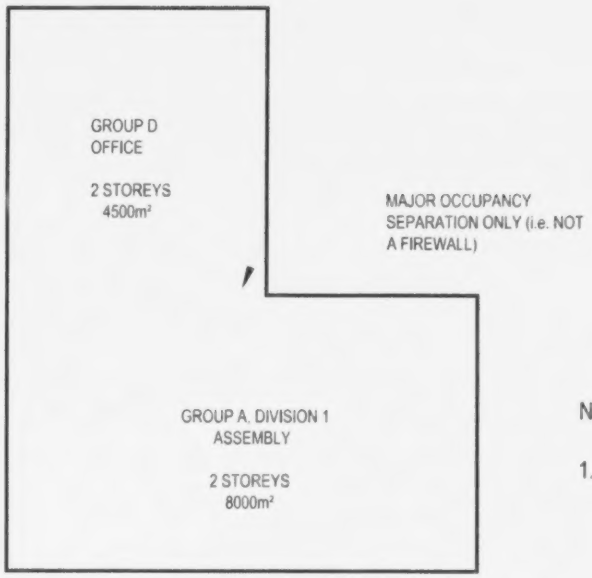
* 3.2.2.7.(1) makes reference to 'portion' of building, therefore, sprinklering only applies to these portions

TABLE 4-6

APPLICATION OF ARTICLES 3.2.2.4 TO 3.2.2.8.				
Occupancy Configuration	Aggregate area, as % of floor area within storey	Multiple Major Occupancy for Application of 3.2.2.20. To 3.2.2.83.	Outcome	References
Single Major Occupancy	N/A	No	- Apply Articles 3.2.2.20. to 3.2.2.83 as applicable based on building height and area.	Sentence 3.2.2.4.(1)
Multiple Major Occupancies	>10% (or Group F, Division 1, Division 2 of any %)	Yes	- Apply 3.2.2.20. to 3.2.2.83. as applicable. - Most restrictive requirements apply to whole building.	Sentences 3.2.2.4.(2) 3.2.2.6.(1) 3.2.2.8.(1) Figure 4-13 Figure 4-14 Figure 4-15
	<10%	No	- Apply Articles 3.2.2.20. to 3.2.2.83 as applicable.	Sentences 3.2.2.4.(2) 3.2.2.8.(1)
Superimposed Major Occupancies	>10% (or Group F, Division1, 2 of any %; or, helipad >10% of roof area)	Yes	- Apply 3.2.2.20. to 3.2.2.83. as applicable. - Apply per major occupancy as though the entire building was of that occupancy classification. - Fire-resistance rating of floor assembly separating each major occupancy based on rating requirement of lower major occupancy.	Sentence 3.2.2.4.(2) Articles 3.2.2.7. 3.2.2.8. Figure 4-14 Figure 4-15
	<10% (or helipad <10% of roof area)	No	- Apply 3.2.2.20. to 3.2.2.83 as applicable.	Sentence 3.2.2.4.(2) Article 3.2.2.8.

STOP

PLAN


GROUP D
OFFICE
2 STOREYS
4500m²
MAJOR OCCUPANCY SEPARATION ONLY (i.e. NOT A FIREWALL)
GROUP A, DIVISION 1
ASSEMBLY
2 STOREYS
8000m²

Note:

1. Building faces 1 street.

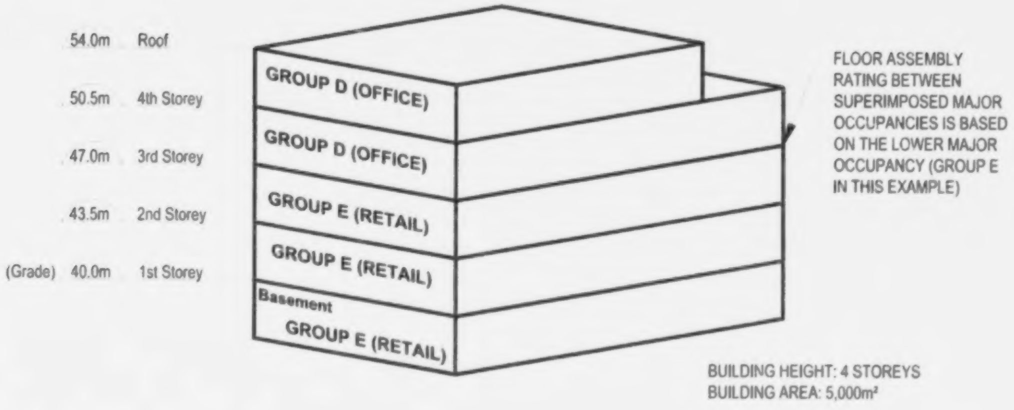
Notes:

MAJOR OCCUPANCY	AREA (m^2)	BUILDING AREA (m^2)	BUILDING HEIGHT	BUILDING CLASSIFICATION (ARTICLE)	CONSTRUCTION TYPE	SPRINKLERS	FLOOR RATING (h)	MEZZANINE RATING (h)	RATING of SUPPORTING ELEMENTS (h)
GROUP D (OFFICE)	4500	12,500 (4500+ 8000)	2 STOREYS	3.2.2.51	NON-COMBUSTIBLE	REQUIRED	1	1	1
GROUP A DIVISION 1	8000			3.2.2.20	NON-COMBUSTIBLE	REQUIRED	**2**	1	1 or 2

Therefore, this building requires:

1. Noncombustible construction.
2. Sprinkler protection throughout.
3. Floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h.
4. Mezzanines must have a fire resistance rating of 1 h.
5. Loadbearing walls, columns and arches must have a fire-resistance rating not less than that of the supported assembly.
6. The major occupancy separation between the Group D and Group A, Division 1 major occupancies must be 1 h per Sentence 3.1.3.1.(1)

FIGURE 4-13

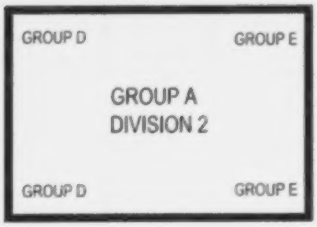

54.0m Roof
50.5m 4th Storey
47.0m 3rd Storey
43.5m 2nd Storey
(Grade) 40.0m 1st Storey
GROUP D (OFFICE)
GROUP D (OFFICE)
GROUP E (RETAIL)
GROUP E (RETAIL)
Basement
GROUP E (RETAIL)
FLOOR ASSEMBLY RATING BETWEEN SUPERIMPOSED MAJOR OCCUPANCIES IS BASED ON THE LOWER MAJOR OCCUPANCY (GROUP E IN THIS EXAMPLE)
BUILDING HEIGHT: 4 STOREYS
BUILDING AREA: 5,000m²

Notes:

1. Construction classification must be based on the building height and building area , per major occupancy. For the example above, assess as:
   a) 4 storey building of Group E major occupancy having a building area of 5,000m²; then as a
   b) 4 storey building of Group D major occupancy having a building area of 5,000m²

FIGURE 4-14

(a)

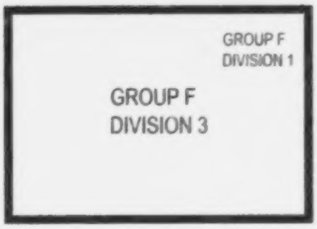

GROUP D
GROUP E
GROUP A
DIVISION 2
GROUP D
GROUP E

Notes:

1. Based on diagram (a):

   a) Primary occupancy- Group A, Division 2
   b) Other occupancies are major occupancies for application of Subsection 3.2.2 if:
   -Area of Group D > 10% of the storey, or
   -Area of Group E > 10% of the storey.

(b)


GROUP F
DIVISION 1
GROUP F
DIVISION 3

Note:

1. Group F, Division 1 or Division 2 occupancies of any area are considered major occupancies for the application of Subsection 3.2.2.

(c)

ROOF
H
HELICOPTER
LANDING PAD

Note:

1. Helicopter landing pad on a roof is not considered a major occupancy if it's area is < 10% of the area of the roof.

FIGURE 4-15

EXERCISE #4-4

1. Consider the building shown in Figure 4-16 and answer the following questions:

   a) What is the building height?
   b) What is the building area?
   c) Identify the major occupancy classifications.

2. Consider the building shown in Figure 4-17 and select the most appropriate construction classification requirements.

   a) Article 3.2.2.62., Group E up to 2 Storeys, Sprinklered

   b) Article 3.2.2.61. up to 2 Storeys

   c) Article 3.2.2.60., Group E, up to 3 Storeys, Sprinklered

   d) Article 3.2.2.58., Group E up to 4 Storeys, Sprinklered

3. Identify, with Code reference(s), how many streets must serve a building of the following composition:

   - Group D
   - 3 storeys in building height
   - Building area of 2 100 m^2
   - Unsprinklered
   - Combustible construction

   ______________________________[______________]

4. Identify the most appropriate construction classification Article(s) applicable to Figure 4-18. What fire-resistance rating must the floor assemblies between the major occupancies provide?

   ____

   ____

   ____

   ____

   ____

   ____

   ______________________________[______________]

5. Review Figure 4-19 and answer the following questions, providing Code references:

   a) What is the appropriate construction classification?

   b) Is the building permitted to be constructed of combustible construction?

   c) Is noncombustible construction permitted?

   d) What fire-resistance rating is required for floor assemblies if constructed of noncombustible construction?

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STOP

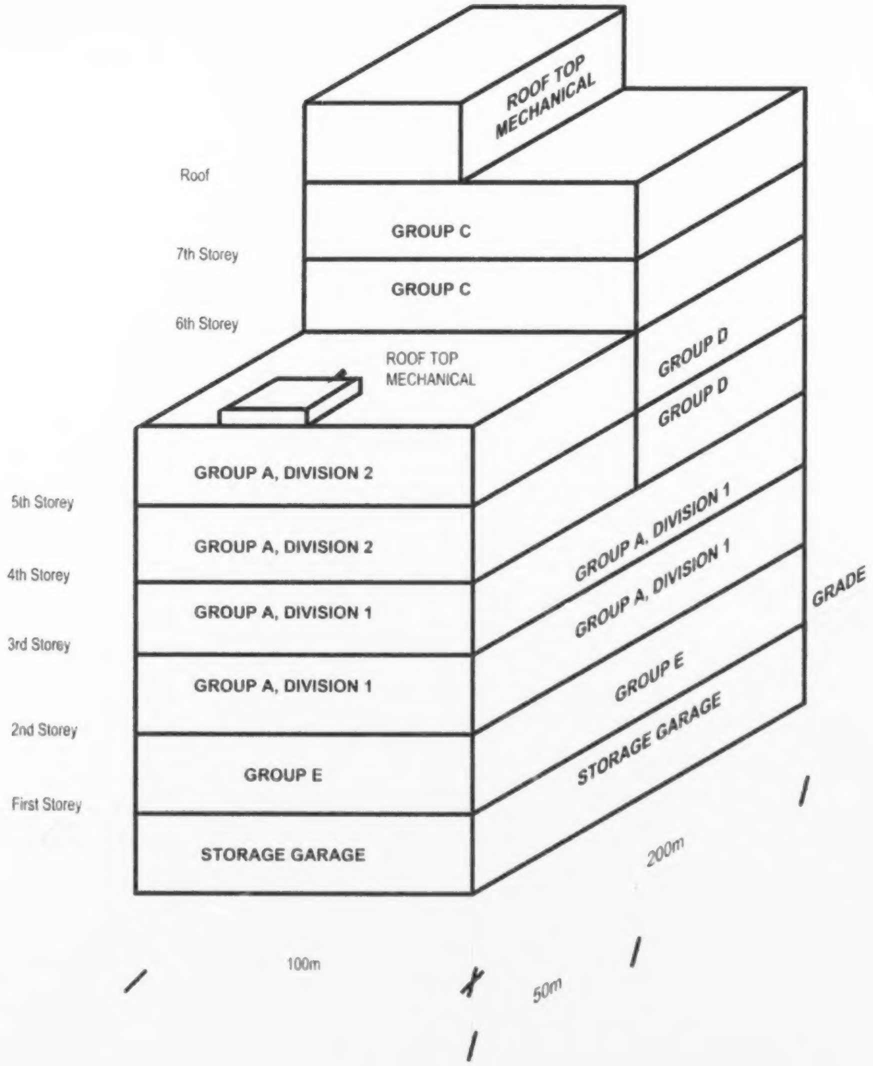
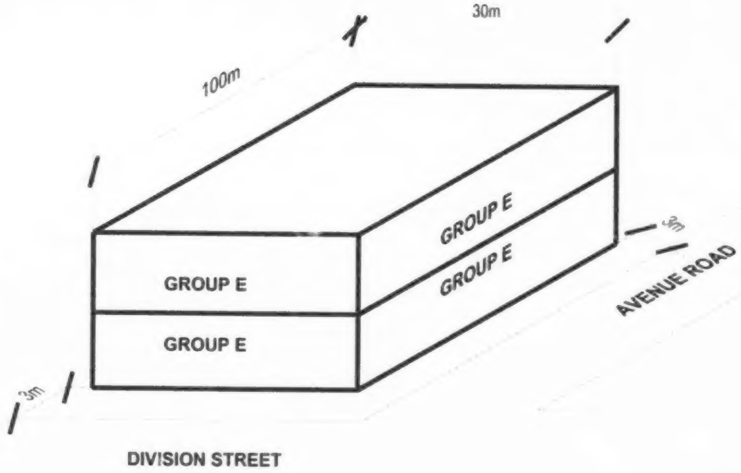

ROOF TOP MECHANICAL
Roof
GROUP C
7th Storey
GROUP C
6th Storey
ROOF TOP MECHANICAL
GROUP D
GROUP D
GROUP A, DIVISION 2
5th Storey
GROUP A, DIVISION 2
GROUP A, DIVISION 1
4th Storey
GROUP A, DIVISION 1
3rd Storey
GROUP A, DIVISION 1
GRADE
GROUP A, DIVISION 1
GROUP E
2nd Storey
STORAGE GARAGE
GROUP E
First Storey
STORAGE GARAGE
200m
100m
50m

FIGURE 4-16


30m
100m
GROUP E
GROUP E
GROUP E
GROUP E
3m
AVENUE ROAD
3m
DIVISION STREET

Note:

1. The building is provided with sprinkler protection throughout.

FIGURE 4-17

Note:

1. The building is provided with sprinkler protection throughout.

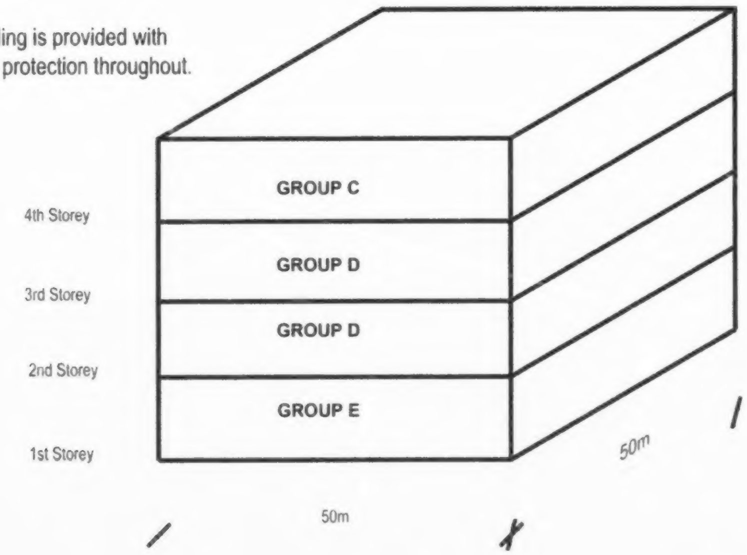
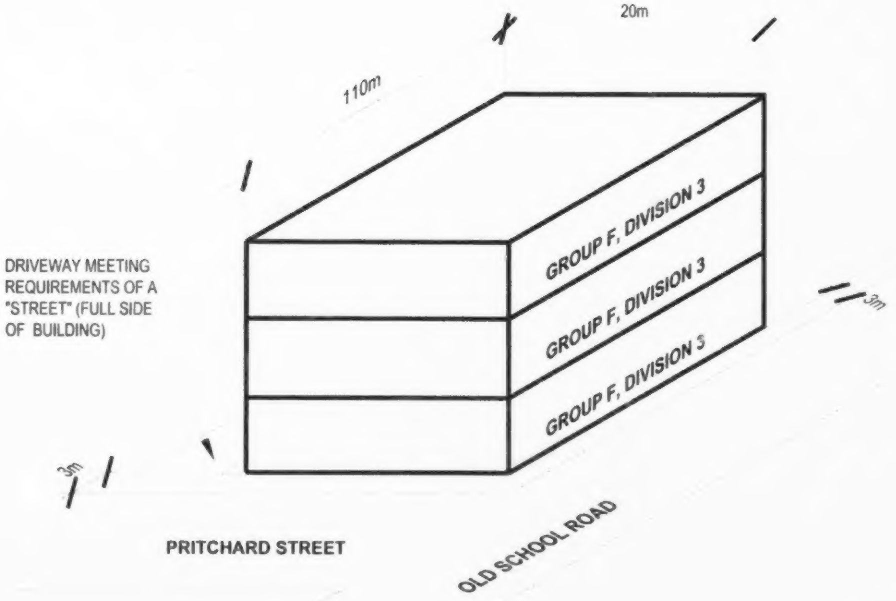

GROUP C
GROUP D
GROUP D
GROUP E
4th Storey
3rd Storey
2nd Storey
1st Storey
50m
50m

FIGURE 4-18


20m
110m
GROUP F, DIVISION 3
GROUP F, DIVISION 3
GROUP F, DIVISION 3
DRIVEWAY MEETING REQUIREMENTS OF A "STREET" (FULL SIDE OF BUILDING)
3m
3m
PRITCHARD STREET
OLD SCHOOL ROAD

Note:

1. The building is NOT provided with sprinkler protection.

FIGURE 4-19

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 5

LARGE BUILDINGS - 2006

BUILDING FIRE SAFETY - PART 2

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

5.1 INTRODUCTION (Subsection 3.2.3, "Spatial Separation and Exposure Protection")

Buildings located in close proximity to each other, or where windows occur in exterior walls of separate fire compartments, present the possibility of fire spread from one building to another by thermal radiation through windows or other unprotected openings.

If there is only one building on the property, then the spatial separation is based on the buildings proximity to the lot lines.

Minimum fire-resistance rating and protection or limits on combustibility of construction of an exposed building face, assist in control of a fire in a subject building, from igniting and spreading to an adjacent building.

This module will concentrate on requirements in the Building Code for determining limiting distances between buildings or properties and the construction of an exposing building face.

This module will include a list of defined terms relating to the content in this module. For a complete list of *definitions*, refer to the Code.

Objectives

Upon completion of this module, you will be able to:

- provide an understanding of the code intent and application of spatial separation requirements
- understand the basis for the factors that regulate the requirements of spatial separations, including limiting distance and the area of unprotected openings

- demonstrate comprehension of applicable Code requirements through the use of "exercises"
- identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer
- learn where the relevant sections are located in the Code, to calculate limiting distances, maximum percentage of openings and determine construction requirements for an exposed building face.

Upon completion of this module, you will be able to:

- calculate limiting distances
- deal with exposure between openings in different fire compartments
- calculate the percentage of permitted unprotected openings for a building fire compartment.

5.2 OVERVIEW

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italicized text. While these terms are shown in italics in this section, they will not appear in italics throughout the remainder of the module.

Exposing building face

Exposing building face (EBF) means that part of the exterior wall of a building that faces one direction and is located between ground level and the ceiling of its top storey; or where a building is divided into fire compartments, the exterior wall of a fire compartment that faces one direction [Sentences 3.2.3.2.(1) and 3.2.3.2.(2)].

See Figure 5-1.

Exposing Building Face [Sentence 3.2.3.2.(1) and 3.2.3.2.(2)]

1. When no fire compartment - Measure to the underside of the ceiling.

2. When there is a fire compartment - Measure between the fire compartments. If the ceiling assembly forms part of the fire separation, then measure to the top of the floor slab (if more than one storey).

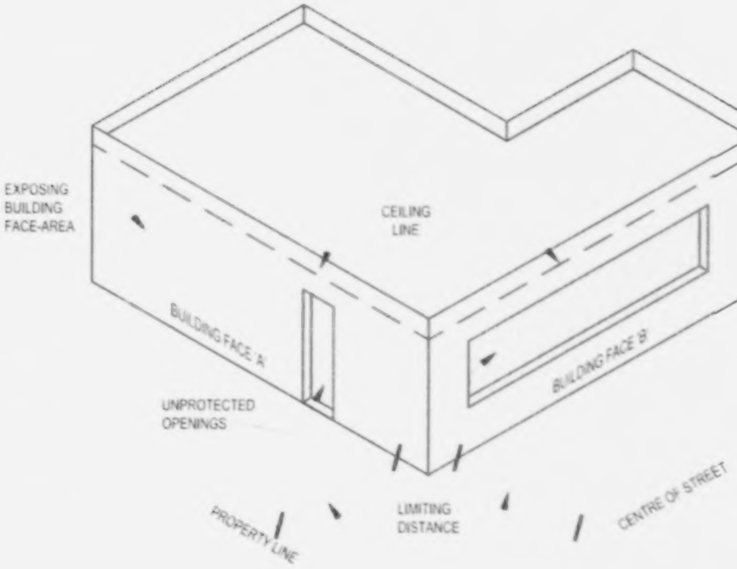

EXPOSING BUILDING FACE-AREA
CEILING LINE
BUILDING FACE 'A'
UNPROTECTED OPENINGS
BUILDING FACE 'B'
PROPERTY LINE
LIMITING DISTANCE
CENTRE OF STREET

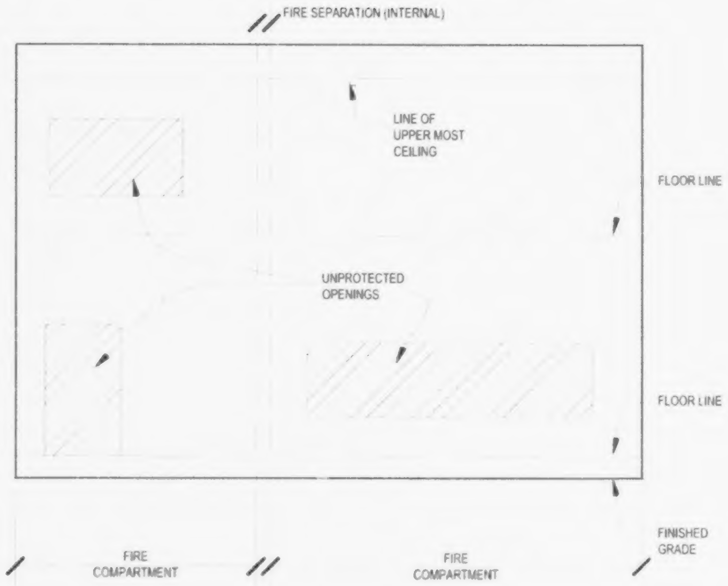
FIGURE 5-1

Fire compartment

Fire compartment means an enclosed space in a building that is separated from all other parts of the building by enclosing construction providing a fire separation that may be required to have a fire-resistance rating [Sentence 3.2.3.2.(2)].

See Figure 5-2.

Fire Compartment


FIRE SEPARATION (INTERNAL)
LINE OF UPPER MOST CEILING
FLOOR LINE
UNPROTECTED OPENINGS
FLOOR LINE
FINISHED GRADE
FIRE COMPARTMENT
FIRE COMPARTMENT

NOTE:

Separate calculation for exposing building face of each fire compartment required.

FIGURE 5-2

Limiting distance

Limiting distance (LD) means the distance from an exposing building face to a property line, the centre line of a street, lane or public thoroughfare, or to an imaginary line between two buildings or fire compartments on the same property, measured at right angles to the EBF [Sentences 3.2.3.1.(8) and (9)].

See Figure 5-3

Limiting Distance

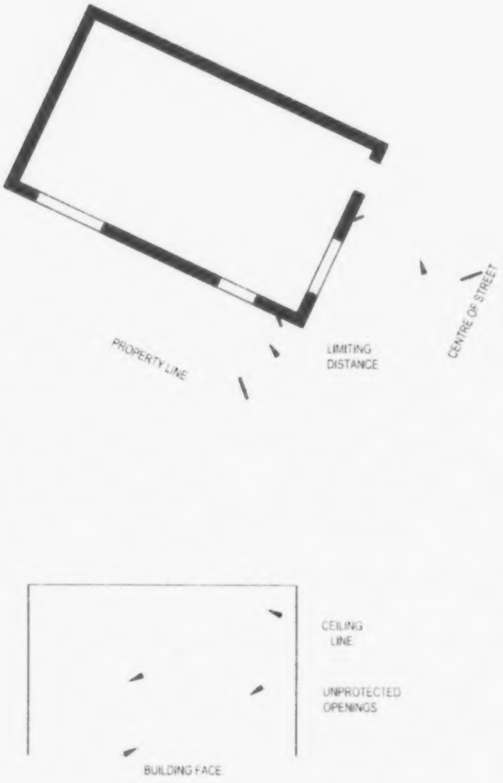

PROPERTY LINE
LIMITING DISTANCE
CENTRE OF STREET
CEILING LINE
UNPROTECTED OPENINGS
BUILDING FACE

FIGURE 5-3

Unprotected opening

Unprotected opening (UO) as applied to an EBF, means a doorway, window or opening other than one equipped with a closure having the required fire-protection rating, or any part of a wall forming part of the EBF that has a fire-resistance rating less than that required for the EBF [Sentences 3.2.3.1.(1) and (2)].

See Figure 5-4

Unprotected Openings

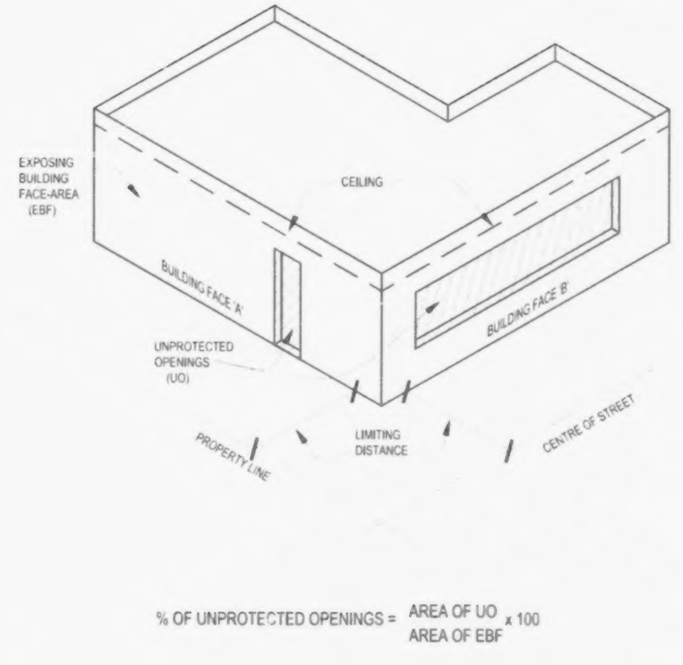

EXPOSING BUILDING FACE-AREA (EBF)
CEILING
BUILDING FACE 'A'
BUILDING FACE 'B'
UNPROTECTED OPENINGS (UO)
PROPERTY LINE
LIMITING DISTANCE
CENTRE OF STREET
% OF UNPROTECTED OPENINGS = AREA OF UO / AREA OF EBF x 100

FIGURE 5-4

Unprotected Openings

An unprotected opening in an exposing building face (EBF) is generally characterized as a window or door opening, and includes any part of a wall forming part of the EBF that has a fire-resistance rating less than that required for the EBF.

Unprotected openings may be protected with closures. Wired glass or glass block are not considered as closures in an exterior wall.

Tables 3.2.3.1.A, B, C and D do not list all possible values for limiting distance and area of exposing building face. Intermediate values may be determined by interpolation.

STOP

EXERCISE #5-1

Read Sentences 3.2.3.1.(1), (2), (4), (5), (6), and (7) and Article 3.2.3.2., and consider Figure 5-5. Class discussion begins in 15 minutes.

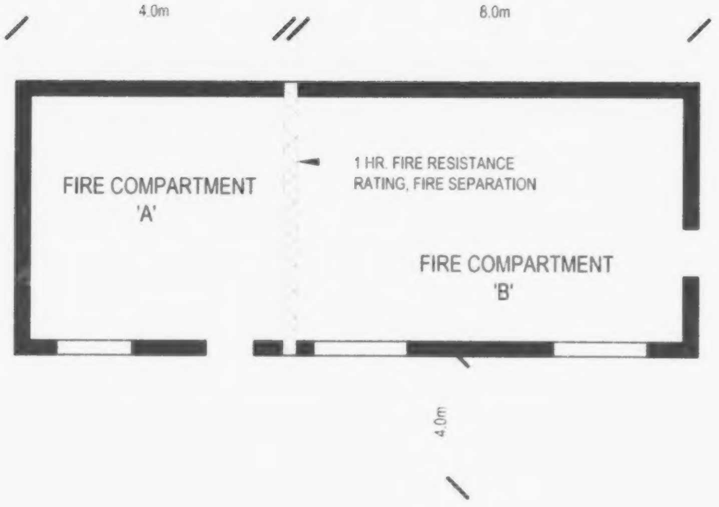
1. Calculate the area of unprotected opening(s) permitted in the south exposing building face. The known values are as follows:

   - The limiting distance is 4.0 m.
   - Fire Compartment 'A' is 4 m by 7.5 m at the EBF.
   - Fire Compartment 'B' is 8 m by 7.5 m at the EBF.
   - The building is a Group D occupancy.
   - The building is not sprinklered.

   [ ]

   The 1 h fire separation between the D occupancies permits the area of EBF to be calculated for each fire compartment [Sentence 3.2.3.2.(2)].

Unprotected Openings


4.0m
8.0m
1 HR. FIRE RESISTANCE RATING, FIRE SEPARATION
FIRE COMPARTMENT 'A'
FIRE COMPARTMENT 'B'
4.0m

NOTE:

FLOOR TO CEILING HEIGHT= 7.5 m

FIGURE 5-5

STOP

Limiting Distances

Limiting distance is the distance from an exposing building face to a property line, the centre line of a street or public thoroughfare, or an assumed line between two buildings or two fire compartments on the same property.

EXERCISE #5-2

1. Read Sentences 3.2.3.1.(3) and (4). Review Figure 5-6 and state how you would determine the allowable percentage of unprotected openings when the limiting distance is not constant.

   Class discussion will start in 15 minutes.

   ____

   ____________________________[__________________]

2. What is the limiting distance that must be used to establish the construction requirement of the exterior wall?

   ____

Read Article 3.2.3.7. and answer the following questions.

3. A sprinklered building having a Group E occupancy has an exposing building face with 40% allowed maximum unprotected openings. Describe the construction of the exposing building face.

   ____

   ____________________________[__________________]

4. An unsprinklered building having a Group F, Division 2 occupancy is allowed an exposing building face with 10% maximum unprotected openings. Describe the construction of the exposing building face.

____

____

______________________________ [______________]

5. A sprinklered building having fire compartments of Group D and Group F Division 1 occupancies has an exposing building face with the following characteristics.

   Group D occupancy has 30% allowable unprotected openings Group F, Division 1 occupancy - 40% allowable unprotected openings.

   Describe the construction of the exposing building faces.

____

____

______________________________ [______________]

STOP

Limiting Distance

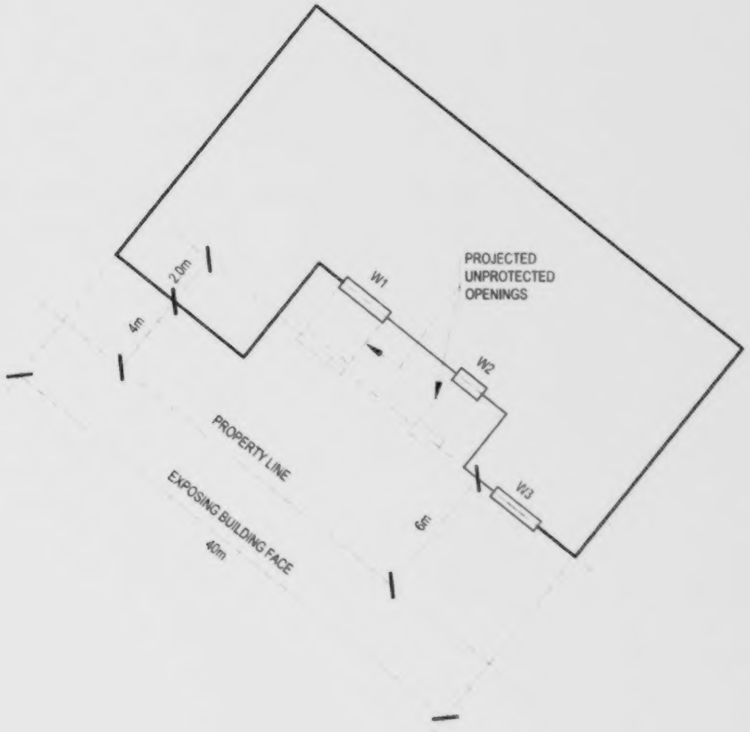

2.0m
W1
PROJECTED
UNPROTECTED
OPENINGS
4m
W2
PROPERTY LINE
W3
6m
EXPOSING BUILDING FACE
40m

FIGURE 5-6

Fire Exposure Between Fire Compartments

The intent of Articles 3.2.3.13. and 3.2.3.14. is to reduce the probability of the spread of fire from one fire compartment to an adjacent fire compartment in the same building through unprotected openings in the exterior wall of the fire compartment of origin.

Where two exposing building faces form an angle of 135º or less (in the case of parallel EBF, the angle of intersection is 0º), there is a potential danger of fire spreading from one fire compartment to the other, if the walls contain openings or do not have sufficient fire-resistance. To reduce this risk, each exterior wall must be constructed with limits on the amount of unprotected openings and with a fire-resistance rating not less than that of the fire separation between the fire compartments and the rest of the building.

This requirement is waived for all fire compartments in sprinklered buildings, except for exit facilities, unprotected openings on opposite sides of firewalls, and exposure from openings in a fire compartment that does not have an automatic sprinkler system [Article 3.2.3.13. and Sentence 3.2.3.14.(3)].

STOP

EXERCISE #5-3

Read Articles 3.2.3.13. and 3.2.3.14. and answer the following questions.

1. An exit stair enclosure has an opening in the exterior wall. The enclosure forms an angle of 75º with the plane of the exterior wall of the building. The exterior wall of the building also has an opening located 10.5 m horizontally from and 1 m above the opening in the exit.

   Are the openings in the building or exit enclosure required to be protected?

   ____

   ____

   ____

   ____

   __________________________[______________]

EXERCISE #5-4

Read Articles 3.2.3.12. and 3.2.3.15. and answer the following questions.

1. Under what conditions may an unprotected opening in an exposed building face be doubled?

   ____

   ____

   ____________________ [__________]

2. A sprinklered building has windows located in a wall two storeys above the roof of a lower storey (same building). The roof has skylights located 2 m horizontally to the exposed wall.

   Is the building permitted to have skylights as described?

   ____

   ____

   ____________________ [__________]

STOP

EXERCISE #5-5

Read Article 3.2.3.9., and answer the following question.

1. A 3 storey office building is constructed with exterior beams and columns (i.e. not heavy timber), supporting the upper two storeys. The columns are located 2.5 m from the property line. The building is constructed in conformance to Article 3.2.2.53. What is the minimum fire protection (fire-resistance rating) required for the exterior structural members?

____

____

__________________________ [__________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 6

LARGE BUILDINGS

BUILDING FIRE SAFETY - PART 3

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

6.1 INTRODUCTION

This part of Building Fire Safety refers to active fire protection and life safety building systems, provisions for fire department access to a building, and interconnected floor spaces other than atriums.

This module will concentrate on requirements in the Building Code for:

- fire alarm and detection systems
- fire department building access
- sprinkler systems
- lighting and emergency power systems
- mezzanines
- interconnected floor spaces, other than atriums
- standpipe systems.

This module addresses Part 3 requirements, which are applicable to new buildings, new additions, and where required by Parts 10 and 11regarding change of use and major renovations.

This module includes a list of defined terms relating to the content in this module. For a complete list of definitions, refer to Part 1, Division A of the Code.

Objectives

- To familiarize Code users where to find requirements for the above listed systems in the Code.

- To understand the steps and the process of applying the Code requirements.

- To demonstrate the procedure/method of applying the Code requirements to obtaining your answer.

Upon completion of this module, you will be able to:

- Determine fire alarm requirements for a building.
- Apply design criteria for fire department building access.
- Identify specific criteria in the Code that applies to sprinkler systems.
- Identify Code lighting and emergency power requirements.
- Determine the types of mezzanines and interconnected floor conditions, and which requirement applies to them.
- Determine which buildings require a standpipe system and identify specific design criteria.

6.2 DEFINITIONS

Definitions

The definitions below relate to the content in this module and are from Part 1, Division A of the Code. Defined terms are found throughout the Code and are identified in italics text. While defined terms are shown in italics in this section, they will not be shown in italics where used elsewhere in this module.

It is important to recognize that a defined term is an integral part of the requirement in which it is found. The defined term must be understood and applied within the context of the requirement.

Alarm signal
Alarm signal means an audible signal transmitted throughout one or more zones of a building or throughout a building to advise occupants that a fire emergency exists.

Alert signal
Alert signal means an audible signal to advise designated persons of a fire emergency.

Building height
Building height means the number of storeys contained between the roof and the floor of the first storey.

Fire compartment
Fire compartment means an enclosed space in a building, (a) that is separated from all other parts of the building by enclosing construction that provides a fire separation, and (b) that may be required to have a fire-resistance rating.

Fire detector
Fire detector means a device which detects a fire condition and automatically initiates an electrical signal to actuate an alert signal or alarm signal and includes heat detectors and smoke detectors.

Heat detector

Heat detector means a fire detector designed to operate at a predetermined temperature or rate of temperature rise.

Interconnected floor space

Interconnected floor space means superimposed floor areas or parts of floor areas in which floor assemblies that are required to be fire separations are penetrated by openings that are not provided with closures.

Mezzanine

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or storey and includes an interior balcony.

Service space

Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts or wires.

Smoke alarm

Smoke alarm means a combined smoke detector and audible alarm device designed to sound an alarm within the room or suite in which it is located upon the detection of smoke within that room or suite.

Smoke detector

Smoke detector means a fire detector designed to operate when the concentration of airborne combustion products exceeds a pre-determined level.

Sprinklered

Sprinklered means equipped with a system of automatic sprinklers.

Storage garage

Storage garage means a building or part of a building that is intended for the storage or parking of motor vehicles and that contains no provision for the repair or servicing of motor vehicles.

Storey

Storey means except for the purposes of Part 7, Division B, the portion of a building, (a) that is situated between the top of any floor and the top of the floor next above it, or (b) if there is no floor above it, the floor that is situated between the top of the floor and the ceiling above.

Street

Street means any highway, road, boulevard, square or other improved thoroughfare that is 9 m or more in width, that has been dedicated or deeded for public use, and that is accessible to fire department vehicles and equipment.

Walkway

Walkway means a covered or roofed pedestrian thoroughfare used to connect two or more buildings.

6.3 FIRE ALARM AND DETECTION SYSTEMS (Subsection 3.2.4.)

General Overview

Subsection 3.2.4. addresses fire alarm system requirements.

In its simplest form, the purpose of a fire alarm system is to alert building occupants of a potential fire condition. A fire alarm system can be activated manually by a person operating a manual pull station. The fire alarm system can also be activated automatically by fire detectors and water flow switches in sprinkler systems.

Occupants of a building are alerted to an alarm activation from audible, and in some mandated cases, from visual devices. In certain conditions, the Code mandates automatic notification of the fire department, either directly or through a proprietary monitoring station.

A fire alarm system may also perform other functions:

- Supervision of auxiliary devices, sprinkler and standpipe shut off valves, fire alarm circuits, fire pump power supply, etc.

- Release magnetic hold-open devices and electromagnetic locks.

- Provide visual indication of location of alarm activation by the fire alarm annunciator.

Fire Alarm System Requirements

The first step is to determine if a building is required to be provided with a fire alarm system. This determination is provided in Sentence 3.2.4.1.(2).

Prior to familiarizing yourself with Sentence (2), an important distinction must be made with respect to Clause 3.2.4.1.(2)(c). The Clause refers to ". . . more than three storeys, including storeys below the first storey". Many requirements in the Code that are dependent on building height refer to "building height". Building height is a defined term and refers to the number of storeys between the first storey and the roof, and does not include storeys below the first storey. The determination of the number of storeys, for the purpose of applying Clause (c), includes storeys below the first storey, as well as the storeys above the first storey.

Procedure to Determine Whether a Building is Required to be Provided with a Fire Alarm System

Take 3 minutes to carefully read the requirements in Sentence 3.2.4.1.(2). In order to clarify the intent of Sentence 3.2.4.1.(2), Sentence 3.2.4.2.(3) should also be reviewed.

1. All buildings that exceed three storeys (including storeys below the first storey) are required to be provided with a fire alarm system [Clause 3.2.4.1.(2)(c)].

2. For buildings of three storeys or less (including storeys below grade):

    i) Determine whether the building complies with Sentence 3.2.4.1.(3) for some dwellings; (4) for some hotels not exceeding 3 storeys; (5) for some open-air garages; or 3.2.4.2.(4) for a building not exceeding three storeys with a continuous 1 h fire separation. If the above does not apply, proceed to (ii) and (iii).

    ii) Determine occupancy classification (refer to Subsection 3.1.2.), then

    iii) Review the Clauses under Sentence 3.2.4.1.(2) individually for applicability to establish the occupant load (refer to Subsection 3.1.17.).

STOP

EXERCISE #6-1

Refer to Articles 3.2.4.1. and 3.2.4.2., and using the above procedure, answer the following questions.

(Circle the correct answer and cite Code reference.)

1. Is a fire alarm system required for a two storey building where both storeys are classified as Group F, Division 2 industrial occupancy, and the occupant load of each storey is 60 persons?

   a) Yes
   b) No

   ____

   ____

   ______________________________[_________________]

2. Refer to Figure 6-1. A two storey addition is proposed to be constructed to the one storey existing building located at the northwest corner of North Shore Avenue and Sunset Beach Road.

   The addition will be separated from the existing building by a fire separation with a minimum 1 h fire-resistance rating.

   The existing one storey building is a restaurant with an occupant load of 143 persons. The two storeys of the addition will be used for offices. The calculated occupant load of the ground floor addition is 85 persons and the second floor is 90 persons.

   Only building service pipes and electrical wiring in noncombustible raceways penetrate the 1 h fire separation. There are no communicating openings in the 1 h fire separation. Which statement below is correct?

a) The entire building is required to be provided with a fire alarm system.

b) Only one suite is required to be equipped with a fire alarm system.

c) No fire alarm system is required.

____

____

______________________________[______________]

STOP

Two-Storey Addition
Plan View

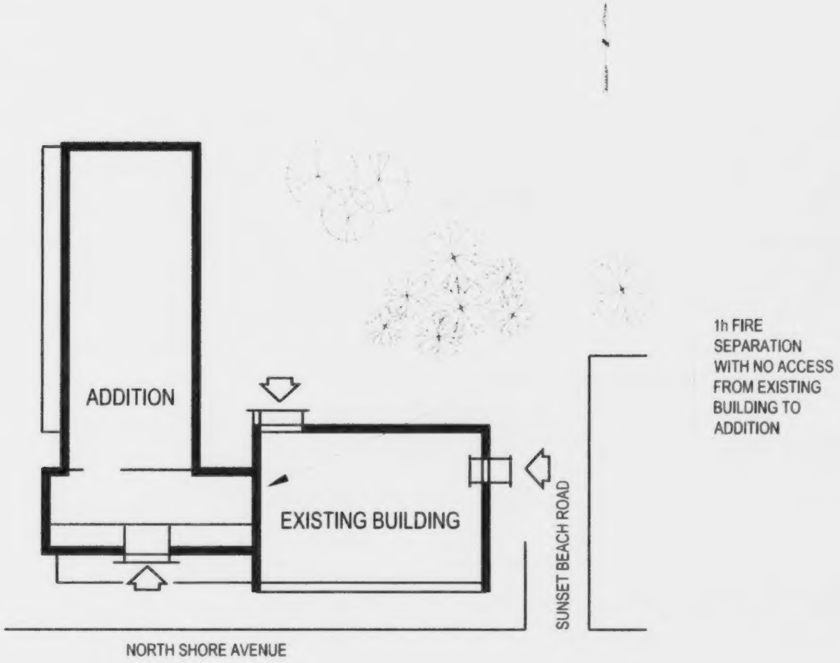

ADDITION
EXISTING BUILDING
1h FIRE SEPARATION WITH NO ACCESS FROM EXISTING BUILDING TO ADDITION
SUNSET BEACH ROAD
NORTH SHORE AVENUE

FIGURE 6-1

Article 3.2.4.5. "Installation and Testing of Fire Alarm Systems" references the appropriate ULC standard for the installation of a fire alarm system including those with voice communication capability [CAN/ULC-S524-M], and for testing and verifying the fire alarm system [CAN/ULC-S537-M].

Types of Fire Alarm Systems

There are two types of fire alarm systems addressed in the Code: single stage and two-stage.

Article 3.2.4.3. "Types of Fire Alarm Systems" identifies the type of fire alarm required based on occupancy classification. Clauses 3.2.4.3.(1)(a) to (d) identify the type of system that is required for specific occupancies. All other occupancies are permitted to be provided with either single stage or two-stage systems.

Article 3.2.4.4. "Description of Fire Alarm Systems" provides the approach (when and how) for causing the alarm signal to activate.

- Single stage - activation of a pull station or fire detector will cause an alarm signal (evacuation signal) to sound on all audible devices.
- Two stage - activation of a pull station or fire detector will cause an alert signal. Manual alarm signal activation is required and initiated by the use of a key or similar device in the manual pull station. Except for a Group B, Division 2 occupancy, the alarm signal must activate automatically if the alert signal is not acknowledged within 5 min. In a building containing a hotel, activation of the alert signal must cause immediate activation of the alarm signal in the initiating fire zone and an alert signal to sound throughout the hotel to notify hotel staff.

Audible and Visual Signals

Article 3.2.4.6. "Silencing of Alarm Signals" provides criteria for silencing the audible devices of a fire alarm system.

Article 3.2.4.18. "Alert and Alarm Signals" provides rules for using audible signal devices for paging and for similar voice messages when the signals are used to sound both alert and alarm signals.

(Refer to Clause 3.2.4.22.(3)(a) for rules as to when alert and alarm signals are permitted to be silenced for the transmission of voice messages.)

Sentences 3.2.4.18.(4), (5) and (6) provide requirements for visual signal devices.

Article 3.2.4.19. "Audibility of Fire Alarm Systems" provides requirements regarding clarity of audible signals throughout a floor area, and minimum required quantitative sound pressure levels, taking into consideration ambient noise levels.

Sentence 3.2.4.19.(2) specifies ISO 8201 as the standard for the temporal pattern of an alarm signal. Sentence 3.2.4.21.(9) requires that the sound patterns of smoke alarms be significantly different from the temporal patterns of alarm signals. Sentence 3.2.4.19.(7) provides requirements for visual signal devises where ambient noise levels exceed 87 dBA, or where the use of ear protection devices are required. Visual signal devices are also required where occupants may be located inside an audiometric booth or sound insulated enclosures. Sentences (9), (10), (13) and (14) provide requirements for the silencing of alarm audible devices inside dwelling units or suites of residential occupancies.

Article 3.2.4.20. also references the requirements for visual signal devices as well as requirements found elsewhere in this Subsection for fire alarms. Therefore, to review all requirements pertaining to visual signal alarm devices, refer to this Article first.

Sentence (1) requires that visual signal devices be visible throughout the floor area, or part of the floor area, where visual signal devices are required in Sentences 3.2.4.18.(4), 3.2.4.19.(7) and (8), and where they are permitted by Sentence 3.2.4.18.(5).

Fire Department Notification

Article 3.2.4.7., "Signals to Fire Department", identifies conditions where specific signals from the fire alarm system are required to be transmitted to the fire department directly, or to a proprietary monitoring station.

The following conditions require the transmission of fire alarm signals to the fire department:

a) Group A (assembly) occupancy with an occupant load exceeding 300 persons,

b) All Group B (detention, care, and care and treatment) occupancies,

c) Group F, Division 1 (high hazard) occupancy,

d) Buildings regulated under Subsection 3.2.6. (high buildings), OR

e) Buildings that contain interconnected floor space that is required to comply with Articles 3.2.8.3. to 3.2.8.11. (atriums).

Where a single stage alarm is installed in an unsprinklered building, a legible notice shall be affixed to the wall near each pull station stating:

a) fire department is to be notified,

b) emergency telephone numbers for either the municipality or the fire department.

It should also be noted that the requirement for automatic fire alarm transmission to the fire department may also originate from Article 3.2.2.17. where a sprinkler system is provided in lieu of a roof fire rating.

EXERCISE #6-2

(Circle the correct answer and cite Code reference)

1. Where a fire alarm system is required, visual alarm signal devices must be provided:

   a) in a compartment referred to in Article 3.3.3.6.,

   b) where ambient noise levels exceed 75 dBA,

   c) in an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA,

   d) in a normally occupied space where the required sound pressure level of the fire alarm audible devices are 10 dBA below the required level.

   ____

   ____

   ______________________________[______________]

Annunciators

Article 3.2.4.8. "Annunciator and Zone Indications" provides criteria for determining whether an annunciator panel is required, and lists the parameters for separate zones on a fire alarm system.

Annunciators are required to be located ". . . in close proximity to a building entrance that faces a street or an access route" [3.2.4.8.(1)].

Annunciators are not required in the following circumstances:

- In a building that has an aggregate floor area for all storeys, not exceeding 2,000 m^2 and does not exceed three storeys in building height [3.2.4.8.(5)].

- If only one zone is required by Sentence 3.2.4.8.(2) [3.2.4.8.(3)].
- In a building where a fire alarm control unit (complete with all trouble alarm signals) is installed at the building entrance that has a fire access route [3.2.4.8.(7)].

If an annunciator is not required and is not installed, a visual and audible trouble signal device is required to be provided inside the building main entrance [3.2.4.8.(4)].

Article 3.2.4.16. "System Monitoring" provides additional annunciation requirements for sprinkler systems.

Electrical Supervision

Article 3.2.4.9., "Electrical Supervision", requires that electrical supervision be provided for all fire alarm systems. If a fire alarm system is installed in a building, a sprinkler system in that building is required to be electrically supervised in compliance with Sentence 3.2.4.9.(2).

In addition, Article 3.2.2.17., "Sprinklers in Lieu of Roof Rating", requires that a sprinkler system that is provided in lieu of roof fire rating, be electrically supervised, regardless of whether the building is required to be provided with a fire alarm system.

EXERCISE #6-3

(Circle the correct answer and cite Code reference)

1. Under what conditions are annunciator panels not required for fire alarm systems?

   a) A building not more than 6 storeys in building height that does not exceed an aggregate floor area of 2,000 m^2 for all storeys.

   b) A building not more than 3 storeys in building height that has an aggregate area for all storeys of not more than 2,000 m^2 .

   c) Where not more than two zones are required.

   ________________________________[________________]

Fire Detectors

Article 3.2.4.10., "Fire Detectors", lists areas where fire detectors are required. Where a fire detector is required, a heat or smoke detector may be used (refer to fire detector definition).

Article 3.2.4.11., "Smoke and Heat Detectors", however, identifies where smoke detectors must be installed and where heat detectors must be provided. Specific areas of specific occupancies require the installation of smoke detectors or heat detectors. In these conditions, a heat detector is not permitted to be used where a smoke detector is required and vice versa.

Duct smoke detection is required by Article 3.2.4.12., "Prevention of Smoke Circulation", in an air handling system that serves more than one storey, one suite or one patient/resident sleeping area fire zone referred to in Sentence 3.3.3.5.(2).

Article 3.2.4.14., "Elevator Emergency Return", provides requirements for smoke detection for elevator recall lobbies.

Elevators that serve floors above the first storey are required to be provided with automatic emergency recall.

Article 3.2.4.15., "Sprinklers in Lieu of Fire Detectors", waives fire detector requirements in Article 3.2.4.10. and heat detector requirements in Sentence 3.2.4.11.(2) in sprinklered floor areas, provided that the sprinkler system is electrically supervised in conformance with Sentence 3.2.4.9.(2).

However, the smoke detector requirements in Sentence 3.2.4.11.(1) are not waived.

Smoke Alarms

Smoke alarms is a defined term and is not the same as a smoke detector. A smoke alarm is not connected to a fire alarm system. It is a detection device as well as audible alarm device. A smoke alarm may be a stand-alone unit or interconnected with other smoke alarms within the same dwelling unit.

Article 3.2.4.21., "Smoke Alarms", applies exclusively to dwelling units, and except for care and detention occupancies that are required to be provided with a fire alarm system, sleeping rooms that are not located within a dwelling unit. Smoke alarms are not required for sleeping rooms in care or detention occupancies that are equipped with a fire alarm system.

Sprinkler Monitoring

Article 3.2.4.16., "System Monitoring", requires sprinkler systems to be provided with water flow detecting devices, and dictates how those devices are to be annunciated on the fire alarm system.

Water flow devices are required to be connected to activate an alarm signal in a single stage fire alarm system and may initiate an alert signal or an alarm signal on a two stage system.

Pull Stations

Article 3.2.4.17., "Manual Pull Stations", identifies where manual pull stations are required to be located.

- Sentence (1) is the primary requirement for pull stations (i.e. pull stations are required near the principal entrance and near every required exit).
- Sentences (2) through (7) apply to hotels or dwelling units.
- Sentence (8) applies to impeded egress zones and contained use areas in Group B, Divisions 1 and 2 occupancies.

Due to barrier-free requirements in Article 3.8.1.5., fire alarm pull stations are required to be located between 900 mm and 1,200 mm above the finished floor.

Pull stations are required to be provided by Clause 3.4.6.15.(4)(f) for the installation of electromagnetic locks.

Voice Communication

Article 3.2.4.22., "Voice Communication Systems", applies primarily to high buildings, with one exception:

- A voice communication system is required for an assembly occupancy with fixed seats, if the aisles are designed to comply with Sentence 3.3.2.4.(14). Clause 3.3.2.4.(14)(f) requires a voice communication system that complies with Article 3.2.4.22.

Clause 3.2.4.22.(1)(a) requires that a two-way communication system for each floor area be provided with connections to the central alarm and control facility (CACF) and to the mechanical control centre.

The requirements in Article 3.2.4.22. are summarized as:

- Sentence (2) – Silencing the alarm signal in single stage system to allow transmission of voice messages is permitted after 30 s.
- Sentence (3) – Silencing the alert and alarm signals in a two-stage system to allow transmission of voice messages is permitted after the alert signal has transmitted for not less than 10 s in hospitals with 24 h supervision or 30 s for all other occupancies.
- Sentence (4) – Loudspeaker system required in Clause 3.2.4.22.(1)(b) be designed for selectivity to any zone or zones.
- Sentence (5) – The emergency telephones for the two-way communication system required in Clause 3.2.4.22.(1)(a) are required to be located on each floor area near each exit stair shaft.

For high buildings subject to requirements of Subsection 3.2.6., "Additional Requirements for High Buildings", the CACF is a separate room that contains other controls and is required to comply with Article 3.2.6.12., "Central Alarm and Control Facility".

The central alarm and control facility, identified in Sentence 3.2.4.22.(1) as applied to an assembly occupancy required by Clause 3.3.2.4.(14)(f) that is not in a high building, is not required to comply with Article 3.2.6.12.

EXERCISE #6-4

(Circle the correct answer and cite Code reference)

1. Where is a smoke detector required to be used:

   a) in a janitor's room,

   b) in every room in buildings classified as Group A, Division 1,

   c) in every corridor in parts of a building classified as Group A, Division 1 major occupancy.

   ____________________ [____________]

2. Sprinklers are permitted by Subsection 3.2.4. in lieu of fire detectors provided:

   a) the sprinkler system is electrically supervised,

   b) the sprinkler system is a wet system,

   c) the building is not subject to the requirements of Subsection 3.2.6.,

   d) the sprinkler system is monitored.

   ____________________ [____________]

STOP

6.4 PROVISIONS FOR FIREFIGHTING GENERAL OVERVIEW (Subsection 3.2.5.)

Subsection 3.2.5. "Provisions for Firefighting"

This Subsection provides requirements for designing means to allow firefighting apparatus and their crew to gain access to a building for the purpose of fighting a fire and for the rescue of building occupants.

The requirements in this Subsection are based on the assumption that firefighting capabilities are available to respond to the building in the event of a fire emergency. Appendix A-3 in the Code must be reviewed as a guideline for applying the requirements of Subsection 3.2.5., which also applies to other fire safety provisions in Part 3, Division B.

Article 3.2.5.1., "Access to Above Grade Storeys", Article 3.2.5.2., "Access to Basements", and Article 3.2.5.3. "Roof Access", provides requirements for access into the building by firefighters. Access is required to be by means of windows, access panels, or doors [3.2.5.2.(2)].

Direct exterior firefighting access is required to all above grade unsprinklered storeys, whose floor level is less than 25 m from each building face that is required to face a street (refer to Figure 6-2) [3.2.5.1.(1)].

The number of building faces that are required to face a street are based on the construction requirements of Articles 3.2.2.20. through 3.2.2.83. Where the construction requirements in Articles 3.2.2.20. through 3.2.2.83. do not specify the number of streets a building is required to face, it is mandated by Sentence 3.2.2.10.(1) that a building face at least one street.

Article 3.2.5.1.

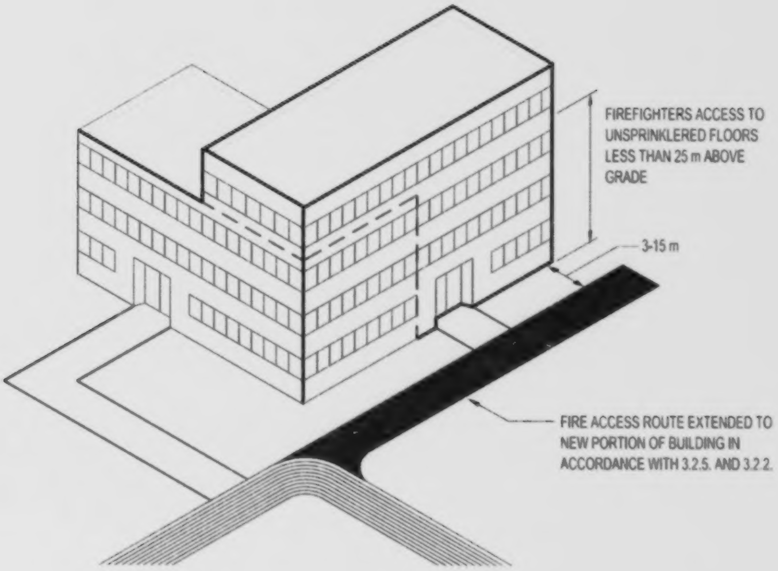

FIREFIGHTERS ACCESS TO UNSPRINKLERED FLOORS LESS THAN 25 m ABOVE GRADE
3-15 m
FIRE ACCESS ROUTE EXTENDED TO NEW PORTION OF BUILDING IN ACCORDANCE WITH 3.2.5. AND 3.2.2.

FIGURE 6-2

Direct firefighter access from the outside is required to each basement that is not sprinklered and that has a horizontal dimension greater than 25 m. The requirement does not apply to sprinklered basements (refer to Figure 6-3) [3.2.5.2.(1)].

In a sprinklered building, storeys above grade and basement levels are permitted to be accessed through a single building entrance.

Article 3.2.5.4., "Access Routes", requires buildings that exceed three storeys in building height, or exceed 600 m^2 in building area, to be provided with a fire access route to the principal entrance and to each building face of unsprinklered floor areas that are required to have direct exterior firefighter access required by Articles 3.2.5.1. and 3.2.5.2.

Where a building is required to face two or more streets, refer to Article 3.2.2.10. "Streets". A building is considered to face two streets if not less than 50% of the building perimeter is located within 15 m of a street or streets. A building is considered to face three streets if not less than 75% of the building perimeter is located within 15 m of a street or streets. The building perimeter that is required to face a street(s) is required by Sentence 3.2.5.5.(1) to be located at least 3 m but not more than 15 m from the street(s) (refer to Figure 6-4).

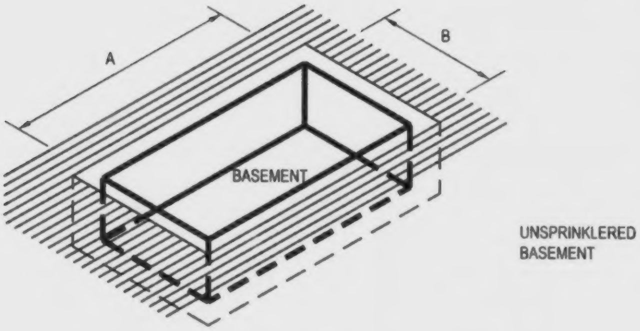
For the purpose of Article 3.2.2.10. requirements, a fire access route designed in compliance with Subsection 3.2.5. is considered a street.

Article 3.2.5.5., "Location of Access Routes", and Article 3.2.5.6., "Access Route Design", provide minimum dimensional design requirements for fire access routes.

- Article 3.2.5.5. outlines the distance requirements between a fire route, fire department connections, building entrances, fire trucks and hydrants (refer to Figure 6-5).

- Sentence 3.2.5.5.(4) applies to conditions where a portion of a building cannot be internally accessed from another part of the building. There may be multiple portions of the same building which are not accessible to each other from the interior (refer to Figure 6-6). The segregated portion of the building must be provided with an entrance that is within 45 m of unobstructed travel from the location of the fire vehicle on the access route, as required in Sentence 3.2.5.5.(2).

Article 3.2.5.2.


A
B
BASEMENT
UNSPRINKLERED
BASEMENT

IF A OR B IS GREATER THAN 25m, DIRECT OUSIDE ACCESS FOR FIRE FIGHTING IS REQUIRED TO THE BASEMENT

TYPES OF ACCESS PERMITTED

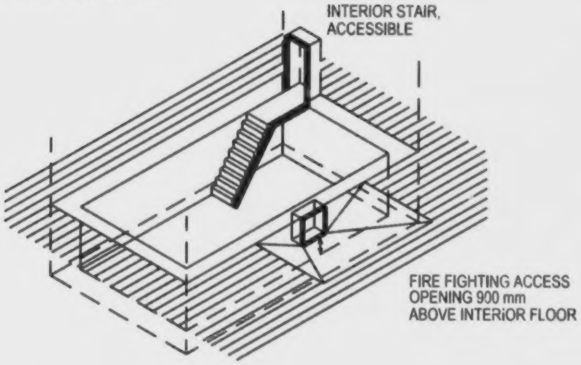
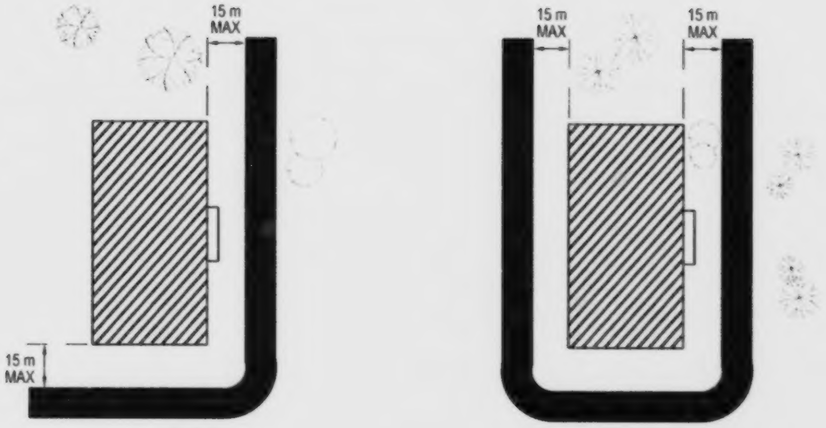

INTERIOR STAIR,
ACCESSIBLE
FIRE FIGHTING ACCESS
OPENING 900 mm
ABOVE INTERiOR FLOOR

FIGURE 6-3

Article 3.2.2.10.


15 m
MAX
15 m
MAX
15 m
MAX
15 m
MAX

FACING 2 STREETS
NOT LESS THAN
50% OF BUILDING
PERIMETER

FACING 3 STREETS
NOT LESS THAN
75% OF BUILDING
PERIMETER

FIGURE 6-4

Clauses 3.2.5.5.(2)(b) & (c)

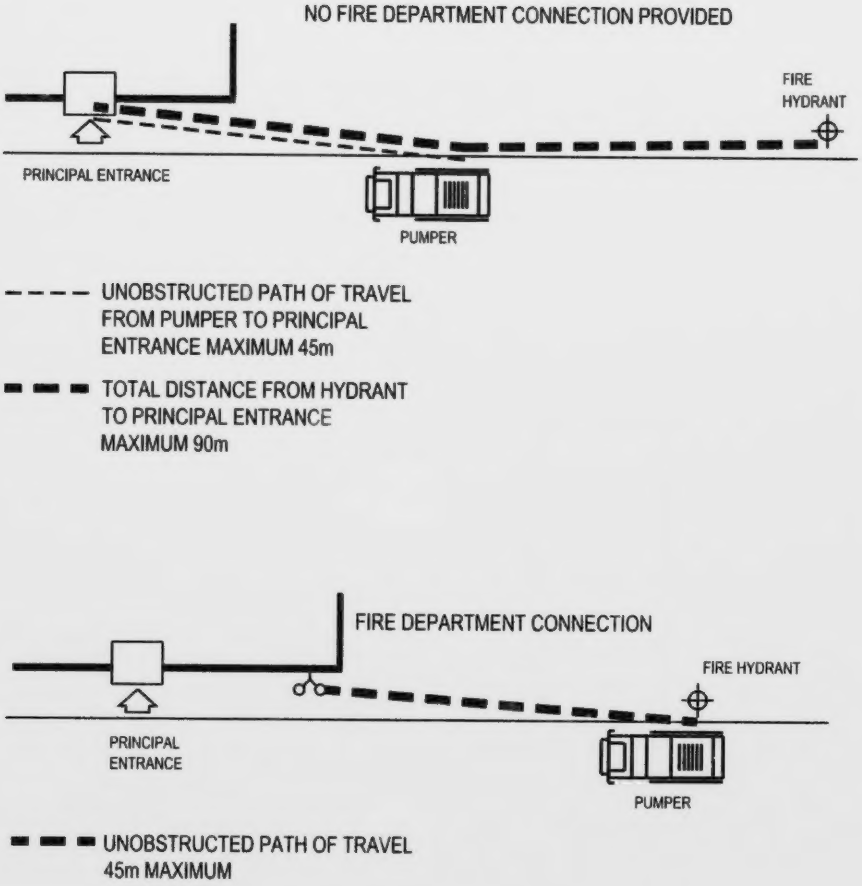

NO FIRE DEPARTMENT CONNECTION PROVIDED
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
- - - - UNOBSTRUCTED PATH OF TRAVEL FROM PUMPER TO PRINCIPAL ENTRANCE MAXIMUM 45m
▬ ▬ ▬ TOTAL DISTANCE FROM HYDRANT TO PRINCIPAL ENTRANCE MAXIMUM 90m
FIRE DEPARTMENT CONNECTION
FIRE HYDRANT
PRINCIPAL ENTRANCE
PUMPER
▬ ▬ ▬ UNOBSTRUCTED PATH OF TRAVEL 45m MAXIMUM

FIGURE 6-5

Sentence 3.2.5.5.(4)

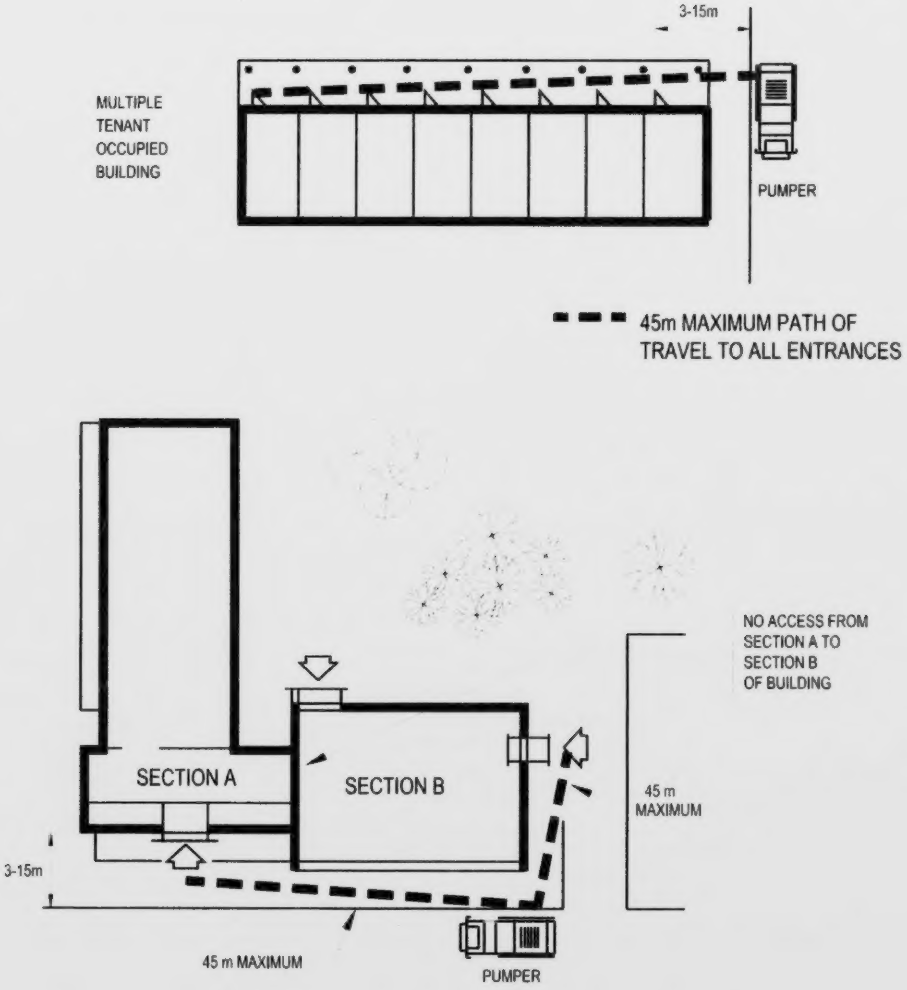

3-15m
MULTIPLE
TENANT
OCCUPIED
BUILDING
PUMPER
45m MAXIMUM PATH OF
TRAVEL TO ALL ENTRANCES
NO ACCESS FROM
SECTION A TO
SECTION B
OF BUILDING
SECTION A
SECTION B
45 m
MAXIMUM
3-15m
45 m MAXIMUM
PUMPER

FIGURE 6-6

- Article 3.2.5.6., "Access Route Design", outlines dimensional criteria of the fire route, such as minimum required width, maximum permitted centre line radius, slope, load capacity, turnaround facilities for dead-end segments and overhead clearances.

  Examples of dimensional criteria are illustrated in Figure 6-7 on the next page.

  As previously stated, buildings must face at least one street.

Article 3.2.5.6.

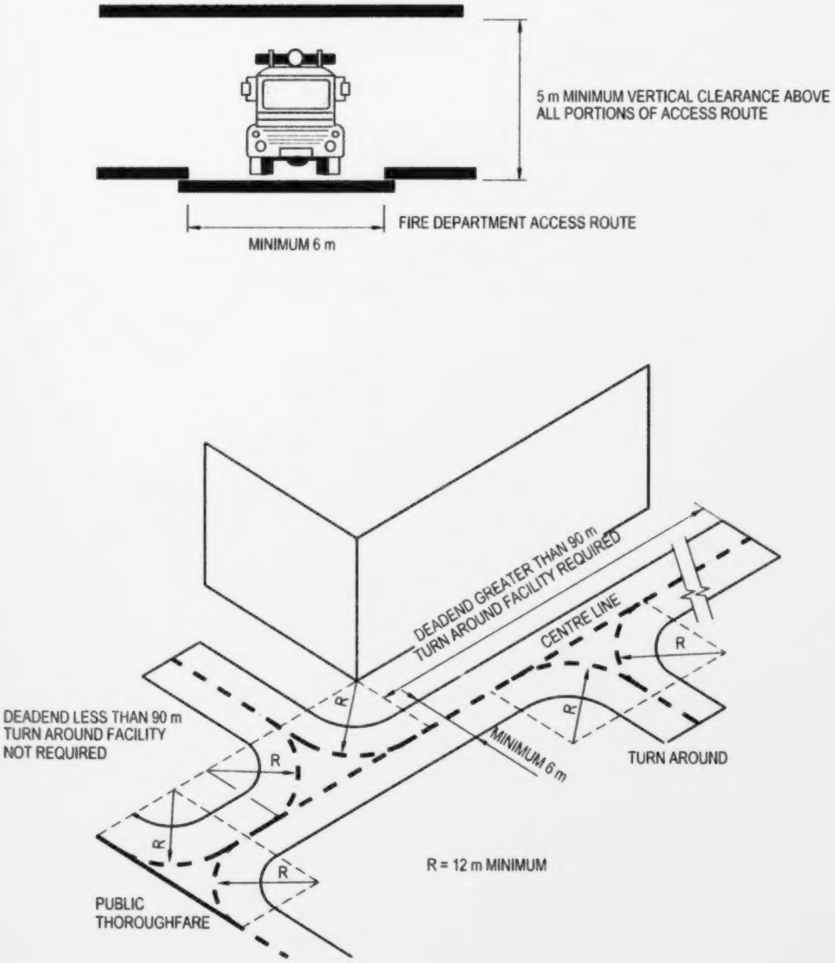

5 m MINIMUM VERTICAL CLEARANCE ABOVE ALL PORTIONS OF ACCESS ROUTE
FIRE DEPARTMENT ACCESS ROUTE
MINIMUM 6 m
DEADEND GREATER THAN 90 m
TURN AROUND FACILITY REQUIRED
CENTRE LINE
R
DEADEND LESS THAN 90 m
TURN AROUND FACILITY
NOT REQUIRED
MINIMUM 6 m
TURN AROUND
R = 12 m MINIMUM
PUBLIC
THOROUGHFARE

FIGURE 6-7

EXERCISE #6-5

Refer to Figure 6-8 and Articles 3.2.5.5. and 3.2.5.6. to complete the following exercise. Take 10 minutes.

The building in the illustration is three storeys in building height, Group C major occupancy (apartment building), is not sprinklered, is provided with a fire alarm system and has a building area of 2,300 m^2. The building is required to face one street.

1. State below, for each alphabet symbol found on Figure 6-8, the required dimension in compliance with Articles 3.2.5.5. and 3.2.5.6. Identify whether this requirement is 'maximum permitted' or 'minimum required', and the Code references to support your answer.

   a) ______________________ [______________]

   b) ______________________ [______________]

   c) ______________________ [______________]

   d) ______________________ [______________]

Article 3.2.5.6.

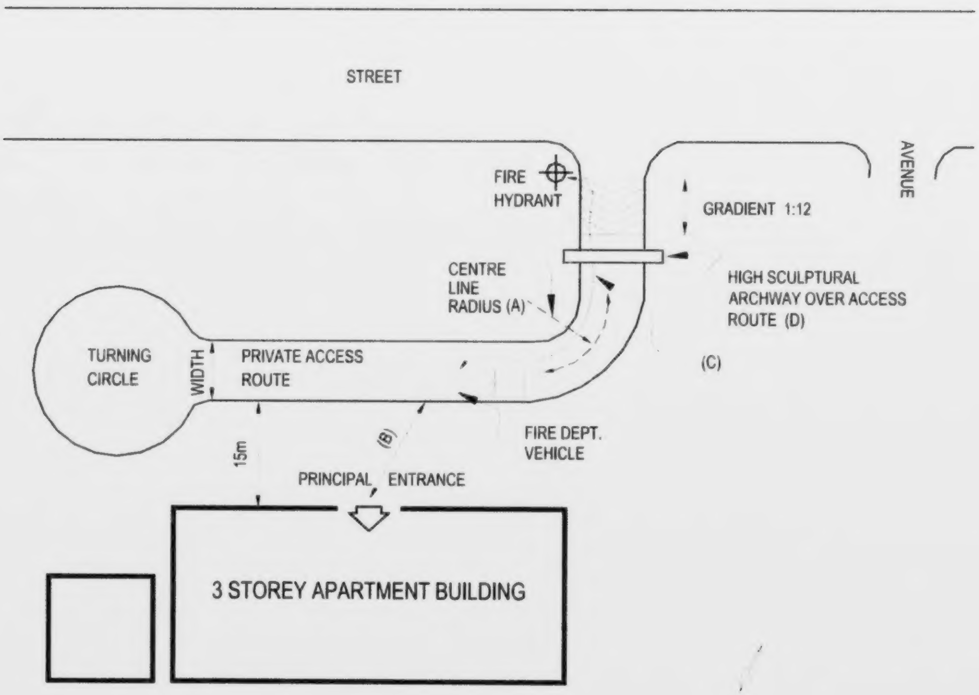

STREET
AVENUE
FIRE HYDRANT
GRADIENT 1:12
CENTRE LINE RADIUS (A)
HIGH SCULPTURAL ARCHWAY OVER ACCESS ROUTE (D)
(C)
TURNING CIRCLE
WIDTH
PRIVATE ACCESS ROUTE
15m
(B)
FIRE DEPT. VEHICLE
PRINCIPAL ENTRANCE
3 STOREY APARTMENT BUILDING

FIGURE 6-8

Water Supply

Article 3.2.5.7., "Water Supply", requires an "adequate water supply for firefighting" to be provided for every building. Sentence 3.2.5.7.(1) refers to A-3.2.5.7 in the Appendix for guidance in determining adequate water supply for firefighting purposes.

Sentence (2) requires that fire hydrants be located within 90 m, measured horizontally from the exterior wall, of any portion of the building perimeter that is required to face a street. For example, 50% of a building perimeter faces a street or streets, and is considered to face two streets; that 50% of the building perimeter is required to be within 90 m of a fire hydrant, measured horizontally from the building face.

Sprinkler Systems

This section of the module identifies sprinkler requirements not only in Subsection 3.2.5. but from other areas in Part 3 of the Code.

Article 3.2.5.13., "Automatic Sprinkler Systems", Article 3.2.5.14., "Combustible Sprinkler Piping", and Article 3.2.5.15., "Sprinklered Service Space", provide design and installation requirements for sprinkler systems.

In general, the above three Articles amend the requirements of NFPA 13, "Installation of Sprinkler Systems", requirements.

The eight Sentences under Article 3.2.5.13, "Automatic Sprinkler Systems", are summarized as:

1. Except as permitted in Sentences (2), (3) and (4), sprinkler systems are required to comply with the design, construction, installation and testing requirements of NFPA 13.

2. NFPA 13R, " Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories in Height", is permitted to be used in a building of residential occupancy that is not more than four storeys in building height, or in a Group B, Division 3 occupancy with not more than 10 persons.

3. NFPA 13D, " Installation of Sprinkler Systems in One and Two Storey Dwellings and Mobile Homes", is permitted to be used in a building of residential occupancy that contains not more than two dwelling units.

4. Where fewer than nine sprinkler heads serve a building, the water supply is permitted to be supplied from the domestic water supply provided that the required flow for the sprinklers can be met by the domestic system.

5. Separate water control valves are required for sprinkler systems and other equipment that is served by the same water supply.

6. Regardless of the requirements of NFPA 13 and NFPA 13R, sprinklers are required in any room or closet in the storey immediately below a roof assembly with the fire-resistance waived as a result of application of Article 3.2.2.17 for sprinklered buildings that are electrically supervised and alarm signals are transmitted to the fire department.

7. Fast response sprinklers are required in care or detention occupancies and in residential occupancies.

8. Sprinklers in elevator machine rooms are required to have a minimum intermediate temperature rating and be protected against physical damage.

Combustible Sprinkler Piping

Sentence 3.2.5.14.(1) limits the use of combustible sprinkler piping to wet systems in residential occupancies and other light hazard occupancies. An example of a light hazard occupancy is Group D, "Business and Personal Services".

The remaining four Sentences identify additional installation requirements necessary to permit combustible sprinkler piping.

Sprinklered Service Space

The five Sentences under Article 3.2.5.15., "Sprinklered Service Spaces", are summarized as:

(1) through (3) Provide requirements for sprinklering a service space that is referred to in Sentence 3.2.1.1.(9) and where flooring used for access within the service space is other than catwalks.

(4) The space below a raised floor in a computer room need not be sprinklered provided that the conditions in Clauses 3.2.5.15.(4)(a) through (e) are met.

(5) Sprinklers for: tenant storage rooms in a residential occupancy, combustible refuse storage rooms, and linen and refuse chutes, are permitted to be supplied from the standpipe system provided the conditions in Clauses 3.2.5.15.(5)(a) through (e) are met.

The edition of the NFPA Standard that is mandated by the Code is provided in Division B, Part 1, Table 1.3.1.2 of the Code.

The determination of whether a building or a floor area is required to be sprinklered is provided in the construction requirements of Subsection 3.2.2., "Building Size and Construction Relative to Occupancy".

Sprinklering of Specific Areas

Requirements for sprinklering of specific areas of a building are also provided in:

- Sentence 3.2.1.5.(1) for basements,
- Sentence 3.2.2.15.(2) for more than one storey below ground,
- Sentence 3.2.8.1.(5) for two storey, interconnected floors within an elementary or secondary school,
- Sentences 3.2.8.2.(5) and (6) for interconnected floors for stairs, and between the first storey and one adjacent storey,
- Article 3.2.8.7. for interconnected floor areas with an atrium (subject to the special protection requirements of Articles 3.2.8.3. through 3.2.8.11.),
- Sentence 3.3.5.4.(7) for storage garages and repair garages located below grade,
- Article 3.3.5.2. references the Fire Code and the National Fire Code of Canada for Industrial occupancies for additional requirements for automatic fire extinguishing systems,
- Sentence 3.6.2.5.(1) for combustible refuse storage rooms, and
- Sentence 3.6.3.3.(6) for linen and refuse chutes.

Fire Department Connections

Article 3.2.5.16. "Fire Department Connections" provides the following criteria for the installation of fire department siamese connections from a sprinkler system and standpipe system:

- Maximum permitted unobstructed distance of 45 m to a fire hydrant.
- The fire department siamese connections must be located outside a building, adjacent to a street or fire route, and not more than 900 mm or less than 300 mm above the ground level.
- Be provided with two 65 mm female swivel hose couplings.

Refer also to Article 3.2.5.5., "Location of Access Routes", for maximum distance requirements between the fire department connections, the fire access route, and firefighter travel distance.

Portable Fire Extinguishers

Article 3.2.5.17., "Portable Fire Extinguishers", refers to Part 6 of the Fire Code for the installation of portable fire extinguishers in buildings.

For buildings required to be provided with a standpipe system, fire extinguishers are required by Sentence 3.2.9.4.(4) to be located in the fire hose cabinets. Additional extinguishers may be required on the floor area outside the fire hose cabinets to meet the spacing requirements for extinguishers in Part 6 of the Fire Code.

Protection From Freezing

Article 3.2.5.18., "Protection from Freezing", applies to any equipment that forms part of a fire protection system that may be adversely affected by freezing temperatures and is located in an unheated area.

Fire Pumps

Article 3.2.5.19., "Fire Pumps", requires that fire pumps with a rated discharge pressure exceeding 280 kPa are required to be installed in compliance with NFPA 20, " Installation of Stationary Pumps for Fire Protection".

Article 3.2.5.19. requires that a fire pump be installed in conformance with the requirements of NFPA 20. A requirement to provide a fire pump for a sprinkler system may be the result of a requirement to provide adequate flow requirements for the sprinkler heads. A requirement to provide a fire pump for a standpipe system may be the result of flow requirements in Subsection 3.2.9., "Standpipe Systems".

EXERCISE #6-6

1. Based on Sentence 3.2.5.15.(5), what are the limits for the number of sprinkler heads in a laundry or refuse chute that are permitted to be supplied by the standpipe system?

____

________________________ [____________]

2. There are two combustible refuse storage rooms that are subject to Article 3.6.2.5. Each room is provided with five sprinkler heads. Are the sprinklers from these rooms permitted to be supplied from the standpipe system? Why?

____

____

____

________________________ [____________]

STOP

6.5 LIGHTING AND EMERGENCY POWER SYSTEMS (Subsection 3.2.7.)

This Subsection provides minimum requirements for normal illumination levels, emergency lighting illumination levels, emergency power for lighting, fire alarm system and building services. Minimum illumination levels for normal and emergency lighting are quantified in Lux (lx) (metric measurement).

Article 3.2.7.1., "Minimum Lighting Requirements", requires adequate illumination levels under normal power conditions to occupied areas to ensure safety of operation and for egress.

Article 3.2.7.2., "Recessed Lighting Fixtures", does not permit the installation of recessed lighting fixtures in an insulated ceiling, unless the lighting fixture is designed for that purpose. Lighting fixtures that are not designed for installation in insulated ceiling spaces may create a fire hazard.

Article 3.2.7.3., "Emergency Lighting", lists all areas that are required to be provided with emergency lighting and the minimum required illumination levels.

The following areas are required to be provided with emergency lighting with an average illumination level of 10 lx:

- Exits
- Principal routes providing access to exit in open floor areas and in service rooms
- corridors used by the public
- corridors serving patients' or residents' sleeping rooms in a Group B, Division 2 or Division 3 occupancy
- corridors serving classrooms
- underground walkways
- public corridors
- floor areas or parts where the public may congregate in
  - Group A, Division 1 occupancies, or

  - Group A, Division 2 or 3 occupancies having an occupant load of 60 persons or more
  - floor areas or parts in daycare centres where persons are cared for
  - food preparation areas in commercial kitchens.

- aisles, internal corridors, and principal routes providing access to exit in a floor area that is not subdivided into rooms, or that is subdivided into rooms in Group D, E and F occupancies (i.e. main passageways that lead to exits).

Emergency lighting is also required at doorways that are equipped with electromagnetic locking devices [Clause 3.4.6.15.(4)(k)].

Article 3.2.7.4., "Emergency Power for Lighting", requires the following minimum duration of emergency power for the emergency lighting required by the previous Article:

- 2 h for high buildings (within the scope of Subsection 3.2.6.),

- 1 h for Group B major occupancies that are not within the scope of Subsection 3.2.6., and

- 30 min for other buildings.

Article 3.2.7.5., "Emergency Power Supply Installation", refers to the CSA-C282, "Emergency Electrical Power Supply for Buildings", standard for emergency power supply installation for buildings other than hospitals.

Emergency power and lighting for health care facilities shall conform to CSA-Z32 "Electrical Safety and Essential Electrical Systems in Health Care Facilities" [3.2.7.6.(1) and 3.2.7.3.(4)].

The required edition of the above CSA standards is provided in Division B, Part 1, Table 1.3.1.2.

Fuel Supply Shut-off Valves and Exhaust Pipes

Article 3.2.7.7., "Fuel Supply Shut-off Valves and Exhaust Pipes", requires an outdoor shut-off valve for an outdoor source of liquid or gas fuel supply to an engine that drives an emergency electric power system.

Sentence (2) requires that exhaust pipes from the engine of an emergency power system be located in a service shaft that has a fire rating at least equal to the fire separation penetrated but in no case less than 45 minutes.

Emergency Power for Fire Alarm Systems

Article 3.2.7.8., "Emergency Power for Fire Alarm Systems", addresses emergency power requirements for the fire alarm system, and for a voice communication system that is required by Article 3.2.6.13., "Voice Communication System".

Sentence 3.2.7.8.(2) requires an emergency power supply for the fire alarm system to be provided by battery, generator or a combination of both. In the event of a power failure, Sentence 3.2.7.8.(4) requires automatic transfer from normal electrical power to emergency power.

Sentence 3.2.7.8.(3) requires the emergency power source for the fire alarm system to be capable of providing supervisory power for a minimum duration of 24 h, plus

- 2 h under full load for a fire alarm system for buildings within the scope of Subsection 3.2.6. (high buildings), or
- 1 h under full load for a Group B building that is not within the scope of Subsection 3.2.6., or
- 5 min under full load for a building that is not required to be equipped with an annunciator [refer to Sentences 3.2.4.8.(3) to (5)], or
- 30 min under full load for all other buildings.

Emergency Power for Building Services

Article 3.2.7.9., "Emergency Power for Building Services", addresses emergency power provisions for specific building services that include:

- elevators,
- water supply for firefighting, and
- fans and electrical equipment used for smoke control.

Emergency power for elevators and other equipment that is required to provide smoke control are high building requirements and are not within the scope of the Large Buildings 2006 course. These requirements are addressed in the Complex Buildings 2006 course.

Protection of Electrical Conductors

Electrical conductors that are used in conjunction with fire alarm systems, and with emergency equipment described in Articles 3.2.6.2. to 3.2.6.8. and Sentences 3.3.3.6.(1) and 3.3.3.7.(4), shall be protected as per Sentences 3.2.7.10.(2) to (8).

Emergency Power for Water Supply for Firefighting

Clause 3.2.7.9.(1)(b) and Sentences 3.2.7.9.(4) and (5) address emergency power requirements for the water supply for firefighting purposes.

A-3.2.5.7 in the Appendix provides guidance in determining adequate water supply for firefighting purposes. With respect to Clause 3.2.7.9(1)(b), for high buildings, water supply refers to the water supply that is required for the sprinkler or standpipe system and that is dependent on electrical power supplied to the building (i.e. if a fire pump is required to provide the required water flow (volume and/or pressure) for the sprinkler or standpipe system).

Emergency power by an emergency generator is required for a water supply that is dependent on electrical power supplied to the building, for the duration of not less than:

- 2 h under full load for buildings within the scope of Subsection 3.2.6. (high buildings) [Clause 3.2.7.9.(1)(b)].
- 30 min under full load for buildings not within the scope of Subsection 3.2.6. This requirement does not apply to a standpipe system [Sentences 3.2.7.9.(4) and (5)]. It applies to sprinkler systems.

Emergency Power for Electrical Equipment for Smoke Control

Emergency power for required smoke control systems are high building requirements and are not within the scope of the Large Buildings 2006 course. These requirements are addressed in the Complex Buildings 2006 course.

EXERCISE #6-7

(Circle the correct answer and cite the Code reference)

1. Based on Subsection 3.2.7., what is the minimum required duration for emergency power for lighting in a hospital that is not within the scope of Subsection 3.2.6.?

   a) 1 h
   b) 2 h
   c) 30 min

   ____

   ____________________[__________]

2. Which statement below is correct regarding emergency power to provide adequate water supply for firefighting in buildings not regulated under Subsection 3.2.6.?

   a) Emergency power is not required to provide adequate water supply to a standpipe system.
   b) Emergency power is required to provide adequate water supply to a standpipe system.
   c) Emergency power is not required to provide adequate water supply to a sprinkler system.

   ____

   ____________________[__________]

STOP

6.6 MEZZANINES AND OPENINGS THROUGH FLOOR ASSEMBLIES (Articles 3.2.8.1. and 3.2.8.2.)

This section covers fire separation requirements for mezzanines and interconnected floors with the exception of atriums that require special protection measures in Articles 3.2.8.3. to 3.2.8.11. The requirements in Articles 3.2.8.3. to 3.2.8.11. are addressed in the Complex Buildings 2006 course.

Article 3.2.8.1., "Application"

Sentence 3.2.8.1.(1) sets the stage for applying the requirements of Subsection 3.2.8., "Mezzanines and Openings Through Floor Assemblies".

All portions of a floor area or mezzanine are required to terminate at an exterior wall, a firewall, a vertical shaft, or a vertical fire separation having a fire-resistance rating not less than that required for the floor assembly, except:

- as permitted by the exceptions provided in Article 3.2.8.2., "Exceptions to Special Protection", for specific mezzanines, openings between floor levels of storage garages, openings for manufacturing processes, openings for stairs, escalators and walks, industrial platforms and walkways, and two-storey interconnected floor spaces consisting of the first storey and one adjacent storey, or

- as permitted by the special protection requirements of Articles 3.2.8.3. through 3.2.8.11. (for atriums).

Sentence 3.2.8.1.(2) does not allow the exemptions in Sentence (1) to apply to the fire separation requirements for exits and vertical service spaces in Sections 3.4, "Exits", 3.5, "Vertical Transportation", and 3.6, "Service Facilities". As such, exits and vertical service spaces are required to be fire separated as required in other parts of the Code.

Sentence 3.2.8.1.(3) does not permit sleeping rooms in a building of Group B, Division 2 or 3 major occupancy to be part of an interconnected floor space.

Sentences 3.2.8.1.(4) and (5) apply to an interconnected floor space within an elementary or secondary school as follows:

- The only type of interconnected floor space permitted is between the first storey and one adjacent storey.
- The interconnected floor space is sprinklered.
- The upper floor of the interconnected floor space is required to be fire separated from the interconnected floor space. A corridor on the upper floor of the interconnected floor space is required to be separated from the interconnected floor space by a fire separation with a minimum 30 min fire-resistance rating. Rooms and occupied spaces on the upper floor of the interconnected floor space are required to be separated from the interconnected floor space by a nonrated fire separation.
- A portion of a floor area that is not located within the interconnected floor space is not permitted to provide access to exit through the interconnected floor space.

Article 3.2.8.2., "Exceptions to Special Protection"

This Article is more commonly used since it applies to 'open' and 'enclosed' mezzanines, openings between floor levels of storage garages, openings for manufacturing processes, openings for stairs, escalators and walks, industrial platforms and walkways, and two storey interconnected floor spaces - consisting of the first storey and one adjacent storey.

Article 3.2.8.2. exempts mezzanines and interconnected floor conditions that comply with Article 3.2.8.2., from complying with the special protection requirements of Articles 3.2.8.3. through 3.2.8.11.

Sentence 3.2 8.2.(1) covers exemptions for five mezzanine conditions. The following mezzanines are not required to terminate at a vertical fire separation or be protected in compliance with Articles 3.2.8.3. through 3.2.8.11. (Refer to Figure 6-9 that illustrates "aggregate area of mezzanines"):

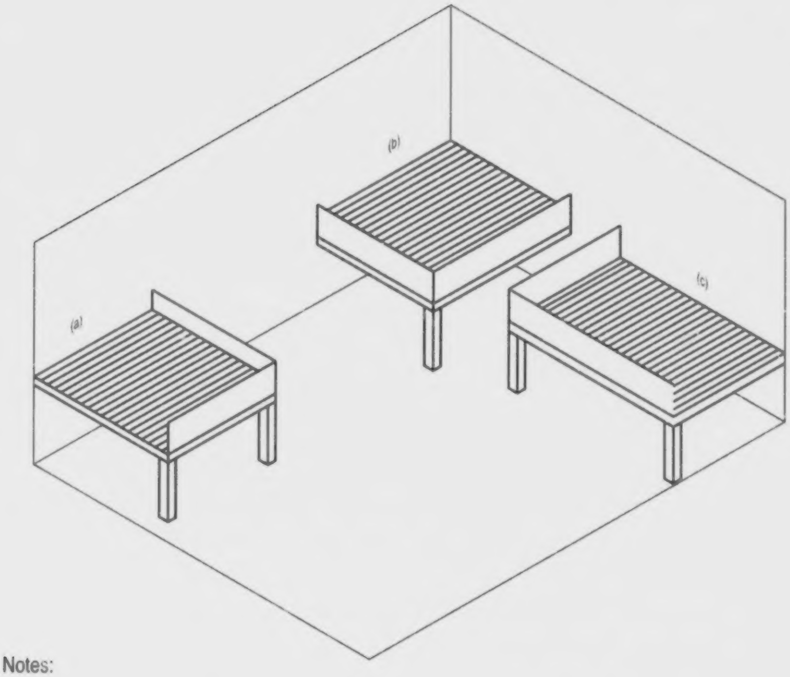
1. Group A, Division 1 Major Occupancy [Clause 3.2.8.2.(1)(a)]

   Mezzanines that serve a Group A, Division 1 major occupancy (assembly occupancies intended for the production and viewing of the performing arts).

2. Group A, Division 3 Major Occupancy [Clause 3.2.8.2.(1)(b)]

   Mezzanines that serve a Group A, Division 3 major occupancy in a building not more than two storeys in building height (assembly occupancies of the arena type).

Aggregate Area of Mezzanines (at same level)



Notes:

1. Aggregate area= (a)+(b)+(c) of mezzanine.

2. Expressed as a % of:

   a) the area of the room or storey in which it is located (Clause 3.2.1.1.(3)(a)) for 40% (open) mezzanine, or
   b) the suite in which it is located if there is more than one suite in the storey (Clause 3.2.1.1.(4)(a)) for 10% (enclosed) mezzanine, or
   c) the storey in which it is located (Clause 3.2.1.1.(4)(b)) for 10% (enclosed) mezzanine.

FIGURE 6-9

3. **Open Mezzanines [Clause 3.2.8.2.(1)(c)]**

   Mezzanines that serve a Group A, C, D, E or F major occupancy, and are not considered a storey by Sentence 3.2.1.1.(3) (i.e. the aggregate area of the mezzanine floor does not exceed 40% of the room or storey in which it is located, is used as an open area with the space above the mezzanine floor not having visual obstructions higher than 1070 mm above the mezzanine floor, except if used for open book shelves in a library in compliance with Sentence 3.3.2.11.(3)). Each level of mezzanine that is partly or wholly superimposed above the first level of mezzanine shall be considered a storey in calculating building height [Sentence 3.2.1.1.(5)].

   Refer to Figure 6-10, "Library Bookshelves on a Mezzanine", and Figure 6-11, "40% (Open) Mezzanine".

4. **Enclosed Mezzanines [Clause 3.2.8.2.(1)(d)]**

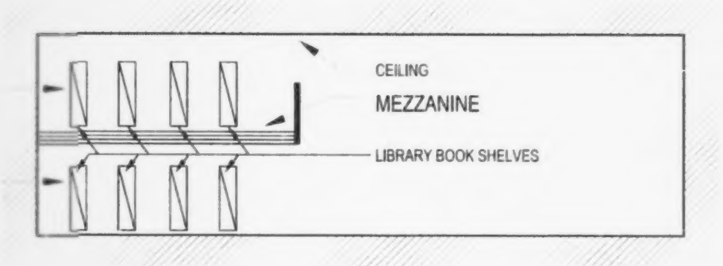
   Mezzanines not considered a storey by Sentence 3.2.1.1.(4) (i.e. the aggregate area of the mezzanine floor does not exceed 10% of the suite in which it is located, where there is more than one suite in the storey; otherwise, the storey in which it is located).

   To be exempt from the fire separation requirements in Clause 3.2.8.2.(1)(d):

   - the area of the mezzanine is not permitted to exceed 500 m^2, and
   - the mezzanine does not contain a Group B occupancy.

   Review Figures 6-12 and 6-13, "10 % (Enclosed) Mezzanine".

Library Bookshelves on a Mezzanine

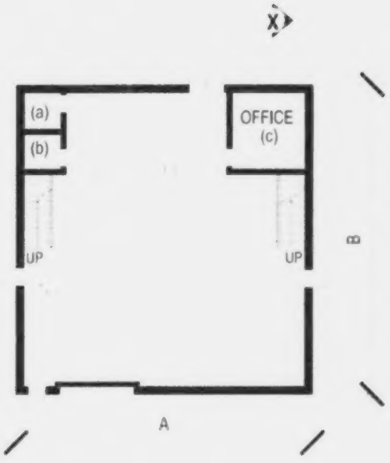

CEILING
MEZZANINE
LIBRARY BOOK SHELVES

Maximum Height of Bookshelves:

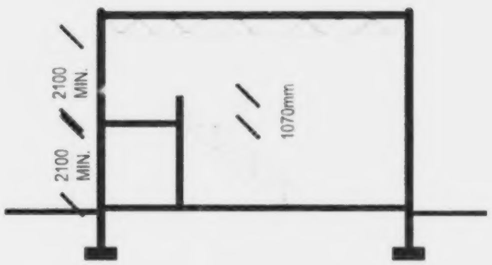
Up to 2100 mm but not more than 75% of the floor-to-ceiling height above or below the mezzanine.

FIGURE 6-10

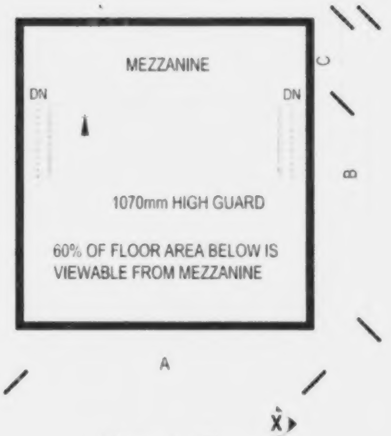
40% (Open) Mezzanine


X
(a)
(b)
OFFICE
(c)
UP
UP
B
A

1st Storey Floor Plan


2100
MIN.
2100
MIN.
1070mm

Section X-X


MEZZANINE
DN
DN
C
B
1070mm HIGH GUARD
60% OF FLOOR AREA BELOW IS VIEWABLE FROM MEZZANINE
A
X

Mezzanine Plan

Notes:

1. $A \times C < 0.4\,[(A \times B) - (a+b+c)]$
2. Used as an open floor area.
3. Visual obstructions higher than 1070mm above mezzanine floor are not permitted except for open bookshelves in a library building.
4. Up to 40% of the area of the "room or suite" (Clause 3.2.1.1.(3)(a)).
5. If conditions are not met this creates a second storey.

FIGURE 6-11

10% (Enclosed) Mezzanine

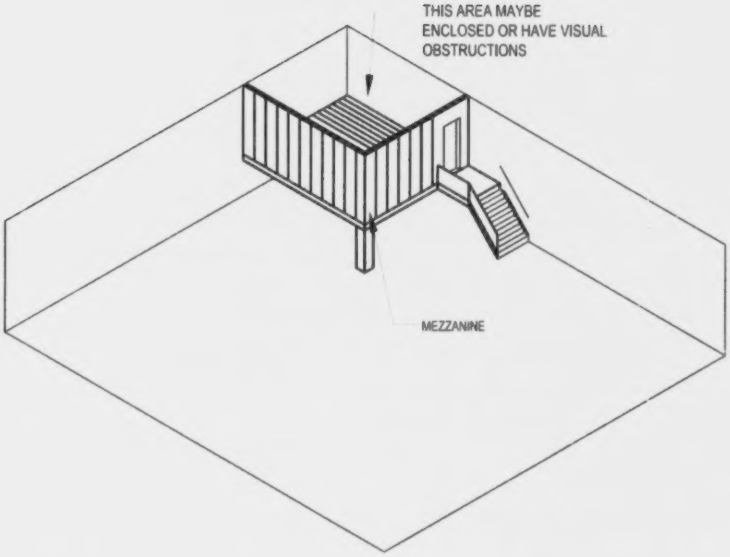
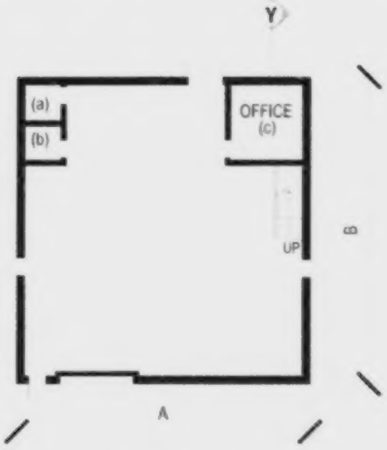
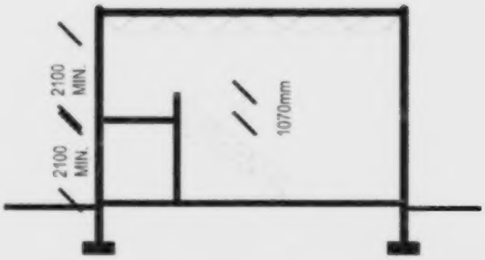

THIS AREA MAYBE ENCLOSED OR HAVE VISUAL OBSTRUCTIONS
MEZZANINE

FIGURE 6-12

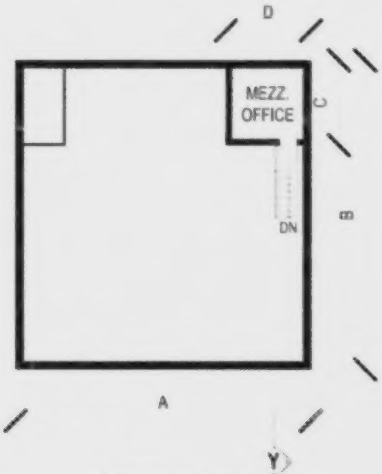
10% (Enclosed) Mezzanine


Y
(a)
(b)
OFFICE
(c)
UP
B
A

1st Storey Floor Plan


2100
MIN.
2100
MIN.
1070mm

Section Y-Y


D
MEZZ.
OFFICE
C
DN
B
A
Y

Mezzanine Plan

Notes:

1. $C \times D < 0.10\,[(A \times B) - (a+b+c)]$
2. Up to 10% of the suite, if there is more than one suite in the storey; up to 10% of the storey, in all other cases.
3. If conditions are not met this creates a second storey.

FIGURE 6-13

5. Industrial Mezzanines, Walkways and Platforms [Clause 3.2.8.2.(1)(e)]

   Mezzanines not considered a storey by Sentence 3.2.1.1.(7) (i.e. mezzanines, elevated walkways and platforms in Group F, Division 2 or 3 major occupancies, provided that the building is of noncombustible construction, and the mezzanines, elevated walkways and platforms are used solely for periodic service or maintenance, or where they are intended to be occupied, are not permitted to exceed an occupant load of four persons) are not required to be fire separated from the storey on which they are located.

   There are no further restrictions in Clause 3.2.8.2.(1)(e) to be exempt from the fire separation requirements.

Storage Garage

Sentence 3.2.8.2.(2) permits openings between floor levels of a storage garage. However, the floor assembly above a basement storage garage that is considered a separate building by Article 3.2.1.2., "Storage Garage Considered as a Separate Building", is not permitted to have unprotected openings.

Industrial Process Openings

Sentence 3.2.8.2.(3) allows openings in fire separations that if provided with a closure would disrupt a manufacturing process. However, precautions are required to be taken to compensate for the resulting hazard.

Detention Occupancies

Sentence 3.2.8.2.(4) allows an interconnected floor space in a Group B, Division 1 occupancy that consists of any two adjacent storeys, but does not restrict one of those storeys as the first storey of the building.

Stair, Escalator and Walkway Openings

Sentence 3.2.8.2.(5) applies specifically to stairs, escalators or walks. To apply this requirement, the building must be sprinklered and the interconnected floor space is restricted to any Assembly occupancy, Group D and Group E occupancies. Floor openings are limited to 10 m^2.

Two Interconnected Storeys

Sentence 3.2.8.2.(6) applies to an interconnected floor space.

EXERCISE #6-8

1. Which of the following conditions does not apply to an interconnected floor space in an elementary or secondary school?

   a) The interconnected floor space is sprinklered.
   b) The interconnected floor space consists of the first storey, and the storey next above or below it, but not both.
   c) Where a portion of the floor space is not within the interconnected floor space, the required access to exit from this portion of the floor area shall not lead through the interconnected floor space.
   d) The interconnected floor space contains only Group A, Divisions 1, 2, or 3; Group D, Group E, or Group F, Division 3 occupancies.

   ____________________[____________]

2. Which of the following statements do not belong?

   Openings for stairways, escalators and inclined moving walks need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.11., provided:

   a) The building is sprinklered throughout.
   b) The interconnected floor space contains only Group A, Divisions 1, 2, or 3, Group D or Group E occupancies.
   c) The opening for each stairway, escalator or walk does not exceed 100 m^2.
   d) The opening for each stairway, escalator or walk does not exceed 10 m^2.

   ____________________[____________]

STOP

6.7 STANDPIPE SYSTEMS (Subsection 3.2.9.)

Standpipe Systems

This module covers standpipe system requirements for design installation, water supply, hose stations, hose cabinets, and area of coverage.

Where Required

A standpipe system is required by Sentence 3.2.9.1.(1) to be installed in every building that:

- is more than three storeys in building height,
- is more than 14 m high measured between the grade and the ceiling of the top storey, or
- is less than 14 m high and has a building area exceeding the area shown in Table 3.2.9.1, for the applicable occupancy classification and number of storeys, if the building is not sprinklered,
- Group B occupancies are not included in the Table since all Group B occupancies are required to be sprinklered.

Basements and Below Ground

Sentence 3.2.9.1.(2) requires a standpipe system to be installed in every basement of a building that requires a standpipe system above grade.

Sentence 3.2.9.1.(3) requires a standpipe system is to be installed in every basement of a building that is regulated by Sentence 3.2.2.15.(2) (erected partially or entirely below the adjoining finished ground level and extends more than one storey below that ground level).

Exceptions - Smaller Spaces and Open Air Garages

A standpipe system is not required by Sentence 3.2.9.1.(4) to be installed in the lowest storey in a building if this storey is a service room, which has a floor area not exceeding 50 m^2.

A standpipe system is not required by Sentence 3.2.9.1.(5) to be installed in a rooftop enclosure if this enclosure has a floor area not exceeding 50 m^2.

Table 3.2.9.1
Building Limits Without Standpipe Systems
Forming Part of Sentence 3.2.9.1.(1)
(for unsprinklered buildings)

Occupancy Classification	Building Area, m^2		
	1 storey	2 storeys	3 storeys
A	2 500	2 000	1 500
C	2 000	1 500	1 000
D	4 000	3 000	2 000
F, Division 2	2 000	1 500	1 000
F, Division 3	3 000	2 000	1 000
Column 1	2	3	4

A standpipe system is not required by Sentence 3.2.9.1.(6) in an open-air storage garage, that is not more than 15 m high, and that conforms to Article 3.2.2.83. (all storeys constructed as open-air storeys, having no other occupancy, being of noncombustible construction, of not more than 10,000 m^2 in building area, and with every portion of each floor area being within 60 m of an exterior wall opening).

Exception for Dwelling Units

A standpipe system is not required by Sentence 3.2.9.1.(7) to be installed in a dwelling unit which:

- does not exceed three storeys above adjacent ground level,
- is completely cut off from the remainder of the building so that there is no access to the remainder of the building (e.g. townhomes), and
- has direct access to its interior by means of an exterior doorway located not more than 1,500 mm above or below the adjacent finished ground level.

STOP

EXERCISE #6-9

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building with a ceiling height of 14 m that is not sprinklered. Which one of the following building areas, occupancy classification and number of storeys will require the installation of a standpipe system?

   a) occupancy classification D, 1 storey, 2,000 m^2

   b) occupancy classification F, Division 3, 2 storey, 1,500 m^2

   c) occupancy classification A, 3 storey, 2,000 m^2

   d) occupancy classification C, 2 storey, 1,000 m^2

   ______________________[______________]

2. Consider a building that requires a standpipe system and includes a rooftop enclosure. Which one of the following enclosure floor areas requires standpipe coverage?

   a) 5 m^2
   b) 10 m^2
   c) 50 m^2
   d) 55 m^2

   ______________________[______________]

STOP

Standpipe System Design

Sentence 3.2.9.2.(1) requires the design, construction, installation and testing of a standpipe system to be in conformance with NFPA 14, "Installation of Standpipe and Hose Systems", except as modified and otherwise provided in Subsection 3.2.9., "Standpipe Systems".

NFPA 14 is the base conformance standard and the additional requirements in Subsection 3.2.9. provide further restrictions and relaxations to NFPA 14.

Standpipe Riser

A standpipe riser is required by Sentence 3.2.9.2.(9) to be located in an exit stair shaft or in a service space.

Dry Standpipe Not Connected to Water Supply

A dry standpipe system that is not connected to a water supply is not considered by Sentence 3.2.9.2.(2) as fulfilling the requirements of standpipe system design by the Code.

Dry Standpipe

If freezing of piping may occur, a dry standpipe system is permitted by Sentence 3.2.9.2.(8) provided that listed devices are used to:

- automatically admit water to the system by the opening of a hose valve, and
- transmit a signal to an attended location.

Water Supply and Pressure

If more than one standpipe is provided, the total water supply need not be more than 30 L/s (1800 L/min) [Sentence 3.2.9.2.(3)].

The residual water pressure at the design flow rate at the hydraulically most remote hose connection of a standpipe system that is required to be installed in a building is permitted by Sentence 3.2.9.2.(4) to be less than 450 kPa provided that:

- the building is sprinklered,
- the water supply at the base of the sprinkler riser is capable of meeting the design flow rate and pressure demand of the sprinkler system, including the inside and outside hose allowance, and
- fire protection equipment (fire department pumper) is available to deliver, by means of the fire department connection, the full demand flow rate at a residual water pressure of 450 kPa at the hydraulically most remote hose connection of the standpipe system.

Fire Department Connections and Fire Pumps

A fire department connection is required by Sentence 3.2.9.2.(5) to be provided for every standpipe system.

Pumps having a rated net head pressure greater than 280 kPa and their controllers are required by Sentence 3.2.9.2.(6) to be listed and labeled.

Couplings for hoses or other fittings used in connection with such couplings are required by Sentence 3.2.9.2.(7) to conform to ULC-S513 " Threaded Couplings for 38 mm and 65 mm Fire Hose" or ULC-S543 " Internal Lug Quick Connect Couplings for Fire Hose".

Supervisory Signal Annunciation for Valves

If a fire alarm system in a building has an annunciator, each valve, except for hose valves (38 mm and 65 mm hose connections) controlling water supplies in a standpipe system is required by Article 3.2.9.5. to be equipped with an electrically supervised switch for transmitting a signal for individual annunciation in the event of movement of the valve handle.

STOP

EXERCISE #6-10

For each of the following questions, review the presented text and use the applicable Code references to select the correct answer using the multiple choice method.

1. The Code permits the residual water pressure in a standpipe system to be less than 450 kPa under a set of conditions. Which one of the following is a specific part of that set of conditions?

   a) The building is sprinklered.

   b) The system conforms to NFPA 14.

   c) Any dry standpipes are connected to a water supply.

   d) Provision of a fire department connection.

   ______________________________ [______________]

2. Based on Article 3.2.9.2., a dry standpipe system is:

   a) not permitted,

   b) permitted,

   c) required to be pressurized with nitrogen,

   d) only permitted in sprinklered buildings.

   ______________________________ [______________]

STOP

Hose Connections

If a standpipe system is required by Article 3.2.9.1., "Where Required", in a building, 38 mm diameter hose connections are required by Sentence 3.2.9.3.(1) to be provided in each storey of the building.

In addition, if a standpipe system is required, 65 mm diameter hose connections are required by Sentence 3.2.9.3.(2) to be installed in each storey of the building, if the building:

- is more than 25 m high, measured between grade and the ceiling of the top storey, or
- has a building area of more than 4,000 m^2.

Hose Stations

If a standpipe system is required in a building by Article 3.2.9.1., hose stations are required by Sentence 3.2.9.4.(1) to be provided in each storey of the building. However, hose stations are not required in areas described in:

- Sentence 3.2.9.1.(4) for the lowest storey in a building that is a service room and does not exceed a floor area of 50 m^2, or
- Sentence 3.2.9.1.(5) for a rooftop enclosure that does not exceed a floor area of 50 m^2, or
- Sentence 3.2.9.1.(6) for storage garages conforming to 3.2.2.83. provided the building is not more than 15 m high, or
- Sentence 3.2.9.1.(7) for dwelling units under certain conditions.

Each hose station is to be equipped with a hose rack filled with not more than 30 m of 38 mm diameter fire hose. The hose rack and fire hose are to be listed or approved by the Factory Mutual Research Corporation.

Hose Cabinets

At each hose station, the hose connections, valves, fire hose, nozzle and hose rack are required by Sentence 3.2.9.4.(3) to be located inside a hose cabinet (except in a Group F occupancy).

A hose cabinet is to be of sufficient size to contain the above equipment, contain a listed fire extinguisher, and provide sufficient clearance to permit the use of a standard fire department hose key [3.2.9.4.(4)].

Hose Station Location

Hose stations are required by Sentence 3.2.9.4.(5) to be located:

- so that every portion of the building can be reached by a hose stream within 3 m of a nozzle attached to the hose,
- not more than 5 m from every required exit serving a floor area, except for the first storey, or

  where additional hose stations are required to achieve full coverage of the floor area, and
- in a conspicuous location where they are not likely to be obstructed.

Hose stations are required by Sentence 3.2.9.4.(6) to be located so that it is not necessary to penetrate an exit with a hose in order to provide the design coverage.

A hose is permitted to penetrate an exit, however, in order to provide the required coverage to:

- a service room referred to in Sentence 3.2.9.1.(4) (i.e. the lowest storey in a building that is a service room and does not exceed a floor area of 50 m^2),
- a rooftop enclosure referred to in Sentence 3.2.9.1.(5) (i.e. rooftop enclosure that does not exceed a floor area of 50 m^2),
- a room not more than 50 m^2 in area, or
- a room or group of rooms not more than 200 m^2 in area in a sprinklered floor area.

A hose station located on one side of a horizontal exit is to be considered to serve only the floor area on that side of the horizontal exit [Sentence 3.2.9.4.(8)].

A hose cabinet is to be located so that its door, when fully opened, will not obstruct the required width of a means of egress [Sentence 3.2.9.4.(9)].

Secure Areas and Lockable Cabinets

A hose station in a Group B, Division 1 major occupancy (detention) is permitted by Sentence 3.2.9.4.(10) to be located in a secure area, or in a lockable cabinet provided that

- identical keys for all cabinets are located at all guard stations, or
- electrical remote release devices are provided and are connected to an emergency power supply.

STOP

EXERCISE #6-11

Circle the correct answer and cite the applicable Code requirement.

1. Consider a building that is 24 m high and requires a standpipe system. Which one of the following conditions meet the requirements of the Code?

   a) for a building area of 3,000 m^2, 65 mm connections are required in each storey,

   b) for a building area of more than 4,000 m^2, 65 mm connections are required in each storey,

   c) for a building area of 4,000 m^2, 45 mm connections are required in each storey,

   d) for a building area of 4,310 m^2, 35 mm connections are required in each storey.

   ______________________[______________]

2. Complete the statement with the correct phrase.

   Based on Subsection 3.2.9., hose station cabinets:

   a) are required for all occupancies,

   b) are not required where tampering may occur,

   c) are not required in only high hazard industrial occupancies (Group F, Division 1),

   d) are not required in any industrial occupancy.

   ______________________[______________]

STOP

Water Supply for 38 mm Hose Connections

If a standpipe and hose system is required, Article 3.2.9.6. requires the water supply to be sufficient to provide a flow, measured at each of the two hydraulically most remote 38 mm diameter hose connections

- of not less than 380 L/min,
- for not less than 30 min,
- at a pressure of not less than 450 kPa, and
- of not less than 190 L/min from each of the two outlets simultaneously.

Water Supply of 65 mm Hose Connections

If 65 mm diameter hose connections are required by Sentence 3.2.9.3.(2), the water supply is required by Sentence 3.2.9.7.(1) to be sufficient to provide a water flow measured at each of the two hydraulically most remote 65 mm diameter hose connections:

- of not less than 1,890 L/min,
- for not less than 30 min,
- at a pressure of not less than 450 kPa, and
- of not less than 945 L/min from each of the two outlets simultaneously.

The following Table summarizes standpipe system flow design as required by Articles 3.2.9.6. and 3.2.9.7.

TABLE 6-1

Building Height (m) or Building Area (m²) (1)	38 mm Hose Connections	65 mm Hose Connections	Minimum Flow (L/min)	Minimum Duration (min)	Minimum Pressure (kPa)	Flow per Outlet (L/min)
≤ 25 m and ≤ 4,000 m²	required	not required	380	30	450	190
> 25 m	required	required	1890*	30*	450*	945*
> 4,000 m²	required	required	1890*	30*	450*	945*

* For 65 mm hose connections.

Notes:

- (1) If the building is less than 84 m high, the required water supply may be supplied through the fire department connection for the 65 mm connection. If the building is 84 m or more high, the required water supply is to be provided by sufficient pumping capacity and be provided with not less than two sources of water supply for the 65 mm connection [3.2.9.7.(2), (3) and (4)].

STOP

EXERCISE #6-12

For each of the following questions, review the presented text and use the applicable Code references to select the correct answer using the multiple choice method.

1. If a building requiring a standpipe system is 84 m high, what provision is required to conform to the water supply requirements in Subsection 3.2.9.?

   a) water flow is permitted to be supplied through the fire department connection,

   b) the water supply must be available for 45 min,

   c) the building must be served by not less than two sources of water supply from a public water system,

   d) supply must be supplemented by a private system.

   ______________________ [__________]

2. A building requires both 38 mm and 65 mm hose connections. Which one of the following water supply flow capacities is the standpipe riser required to be designed to?

   a) 1,890 L/min
   b) 945 L/min
   c) 450 L/min
   d) 380 L/min

   ____

   ______________________ [__________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 7

LARGE BUILDINGS - 2006

SAFETY WITHIN FLOOR AREAS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

7.1 INTRODUCTION (Section 3.3)

This section deals with safety within floor areas. Subsection 3.3.1. applies to all occupancies in general, whereas Subsections 3.3.2. to 3.3.5. contain requirements that apply only to specific occupancies This module will deal with:

- Fire separations of occupancies and corridors
- Egress requirements
- Design criteria for doors, corridors, guards
- Protection on floor areas with a B/F Path of Travel
- Special requirements for major occupancies

Objectives

Upon completion of this module, you will be capable of:

- Understanding the principles underlying measures designed to ensure fire safety within floor areas.

- Describing the requirements and need for fire separation of occupancies and corridors.

7.2 OVERVIEW

Definitions

The following definitions are taken from Division A, Part 1 of the Code. While italicized in this section, they will not be italicized in the remainder of this module.

Access to exit
Access to exit means that part of a means of egress within a floor area that provides access to an exit serving the floor area.

Floor area

Floor area means the space on any storey of a building between exterior walls and required fire walls including the space occupied by interior walls and partitions, but not including exits, vertical service spaces and their enclosing assemblies.

This definition is very precise and can work to your advantage by allowing you to deduct the area of exits and vertical shafts from the area referred to as "floor area" for different Code purposes. Also note that "floor area" is different from "building area". Furthermore, it is important to remember that floor area refers to the area on a storey and thus has a different intent when the Code refers to a separation from the "remainder of the floor area", versus a separation from the "remainder of the building".

Fire separation

Fire separation means a construction assembly that acts as a barrier against the spread of fire.

The Appendix note to this definition explains that a fire separation may or may not have a fire-resistance rating. Thus, where the Code waives the fire-resistance rating, the assembly must still function as a fire separation, even if it has a 0 h FRR. The intent is not that there be no resistance to the spread of fire, but rather that the fire separation prevents the spread of fire until the suppression system has actuated and controlled the fire within the fire compartment.

In most buildings, the normal construction of the partitions and other subdividing assemblies would result in fire-resistance ratings of 10 to 15 minutes.

Means of egress

Means of egress means continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure to an open public thoroughfare. Means of egress includes exits and access to exits.

Public corridor

Public corridor means a corridor that provides access to exit from more than one suite.

There is a term "corridor used by the public" that is not a defined term. Later in this module we will explain the similarities and differences between these terms.

Suite

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for business and personal service occupancies.

Section Organization

Section 3.3 is divided into five Subsections.

The first, Subsection 3.3.1., deals with requirements that apply to all floor areas.

The remaining Subsections each deal with a specific occupancy classification that requires special rules to address their unique characteristics or conditions. These occupancies are:

- 3.3.2. Assembly Occupancies (i.e. Group A)
- 3.3.3. Care and Detention Occupancies (i.e. Group B)
- 3.3.4. Residential Occupancies (i.e. Group C)
- 3.3.5. Industrial Occupancies (i.e. Group F)

STOP

7.3 FIRE SEPARATIONS

There are three types of fire separations addressed in Section 3.3. They are fire separations of:

- suites of rooms based on major occupancy or tenancy (suites)
- public corridors or corridors used by the public (note, what is normally referred to as a mall is actually a public corridor)
- specific types of rooms, uses related to specific major occupancies.

Separation of Suites

Article 3.3.1.1. is a general requirement that suites shall be separated from adjoining suites by a 1 h fire separation, except where the floor assembly above or the floor assembly below (where there is no floor assembly above) is permitted to be less than 1 h, a ¾ h fire separation is permitted. There are two exceptions to this general rule.

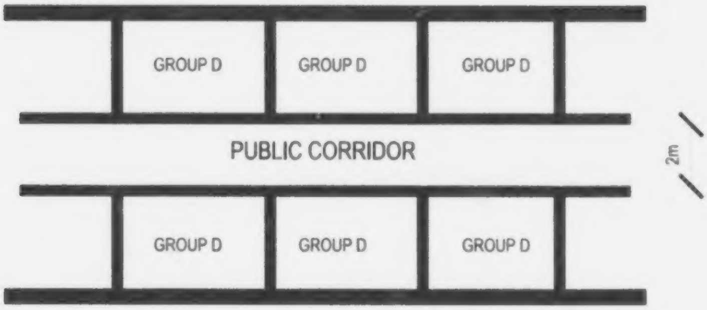
- This requirement does not apply to business and personal service occupancies (Group D). Thus in a multi-tenant office building, sprinklered or unsprinklered, there is no separation required between Group D tenants [Sentence 3.3.1.1.(1)].

- This requirement is waived by Sentence 3.3.1.1.(3) in a sprinklered building for business and personal service occupancies, mercantile occupancies, and fast food outlets without seating for patrons, if they are served by a public corridor that is:
    - sprinklered
    - 9 m or more in width
    - minimum ceiling height in the corridor is 4 m
    - no more than one-half of the required egress doors from rooms or suites that open into the public corridor (where they are required to have more than one egress doorway)

- an unobstructed width of 3 m is maintained between the occupancy (kiosk) and the suites on each side fronting on the corridor
- the combined area of all occupancies within the public corridor is not more than 15% of the area of the public corridor [Clause 3.3.1.4.(4)(b)].

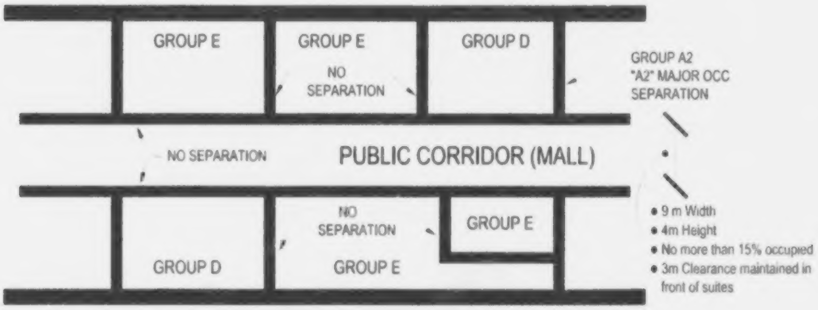
See Figure 7-1 (a) for separation of suites and public corridors.

Separation of Suites and Public Corridors


GROUP D
GROUP D
GROUP D
PUBLIC CORRIDOR
2m
GROUP D
GROUP D
GROUP D

GROUP D UNSPRINKLERED - NO TENANT SEPARATION [3.3.1.1.(1)]
- PUBLIC CORRIDOR SEPARATION ¾ h [3.3.1.4.(2)]

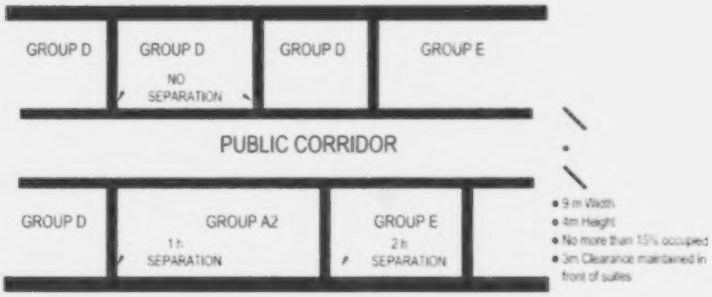
GROUP D SPRINKLERED - NO TENANT SEPARATION [3.3.1.4.(3)]
- NO RATING ON PUBLIC CORRIDOR


GROUP E
GROUP E
NO SEPARATION
GROUP D
GROUP A2
"A2" MAJOR OCC SEPARATION
NO SEPARATION
PUBLIC CORRIDOR (MALL)
NO SEPARATION
GROUP E
GROUP D
GROUP E
• 9 m Width
• 4m Height
• No more than 15% occupied
• 3m Clearance maintained in front of suites

GROUP D, E AND A2 SPRINKLERED (TAKE-OUT) - NO SEPARATIONS [3.3.1.4. (4)(b]

FIGURE 7-1 (a)

Occupancy Separations


GROUP D
GROUP D
NO SEPARATION
GROUP D
GROUP E
PUBLIC CORRIDOR
GROUP D
GROUP A2
1 h SEPARATION
GROUP E
2 h SEPARATION
• 9 m Width
• 4m Height
• No more than 15% occupied
• 3m Clearance maintained in front of suites

FLOOR AREA WITH MIXED MAJOR OCCUPANCIES

- Tenant separations as per table 3.1.3.1 or 1 h except for Group D.

- Public corridor separation is 0 h. if sprinklered floor area.

- No tenant separation between D and E or E and E if public corridor is provided with :- 9m Width
  - 4m Height
  - no more than 15% occupied
  - 3m clearance maintained in front of suites [3.3.1.4. (4)(b)]

FIGURE 7-1 (b)

When applying this waiver of fire separation between tenants, you must be aware of other fire separation requirements that may still apply. If you have a mall with the required 9 m width with a retail unit flanked on one side by another retail unit and on the other side by a restaurant, the separation between the two retail units is waived, but the major occupancy separation (2 h) between the Group E and Group A2 occupancy required by Article 3.1.3.1. would still apply. See Figure 7-1 (b) for occupancy separations.

Separation of Corridor Used by the Public

For certain types of major occupancies, like assembly occupancies (schools, churches, museums, theatres, etc.) and Care and Detention occupancies (hospitals, nursing homes, jails) the building or floor area is occupied by a single tenant. The corridors that function as a means of egress for these floor areas do not fit into the strict definition of public corridor. The Code addresses these corridors in Subsections 3.3.2. and 3.3.3. that deal with specific life safety requirements that are unique to certain major occupancies. The Code refers to these corridors as "corridors used by the public". This term is not a defined term.

Separation of Public Corridors

In general, Article 3.3.1.4. requires public corridors to be separated from the remainder of the storey by a fire separation with a ¾ hr FRR. There are exceptions to this general rule.

- A fire separation with 0 h FRR is permitted if the storey is sprinklered and the corridor does not serve a Group B (care or detention) or Group C (residential) occupancy [Sentence 3.3.1.4.(3)].

- No fire separation at all is required in a sprinklered storey if the travel distance from any part of the floor area to an exit is not more than 45 m, except for patient and resident sleeping rooms, and suites of residential occupancy [Clause 3.3.1.4.(4)(a)].

- A fire separation is not required between a public corridor and an occupancy within the public corridor, if [3.3.1.4.(b)]
  - The building is sprinklered.
  - The public corridor is 9 m or more in width.
  - The minimum ceiling height in the corridor is 4 m.
  - No more than one-half of the required egress doors from rooms or suites that open into the public corridor (where they are required to have more than one egress doorway) [3.4.2.5.(1)(d)].
  - An unobstructed width of 3 m is maintained between the occupancy (kiosk) and the suites on each side fronting the corridor [3.3.1.9.(6)(a)].
  - The combined area of all occupancies within the public corridor is not more than 15% of the area of the public corridor [Clause 3.3.1.9.(6)(b)].
- No fire separation is required between a public corridor and a washroom in a sprinklered building, if the fire separation required for the corridor is provided around the washroom [Sentence 3.3.1.4.(4)(c)].

Throughout the Code, particularly in Section 3.4 for Exits, you will find that both types of corridors are referred to and generally are treated equally (i.e. what applies to one can be applied to the other).

STOP

EXERCISE #7-1

Take 10 minutes to complete the following questions. Give the Code references where applicable.

1. For the public corridors shown in Figure 7-2 (a) and (b), indicate the rating of the fire separation for the public corridor and the applicable Code reference for the following conditions.

   a) The building is occupied as a business and personal services major occupancy and is regulated by Article 3.2.2.53. The building is not sprinklered. The corridor is 2 m wide (see Figure 7-2 (a)).

   ____

   ____

   ____

   ____________________ [__________]

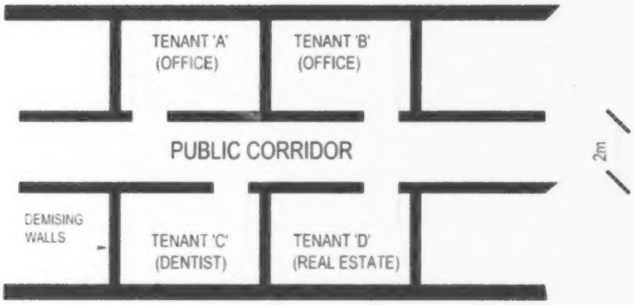
   b) The building is occupied as a mercantile major occupancy and is regulated by Article 3.2.2.60. The corridor is 9 m wide (see Figure 7-2 (b)).

   ____

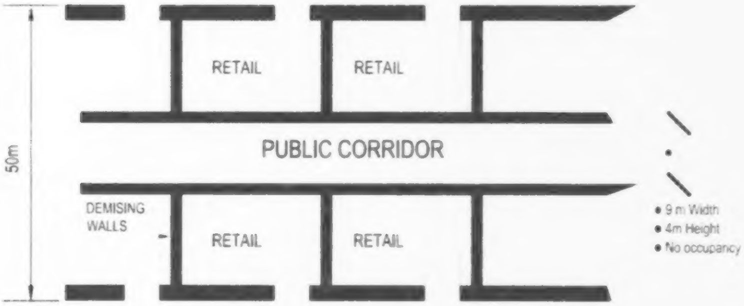
   ____

   ____________________ [__________]

Public Corridor


TENANT 'A'
(OFFICE)
TENANT 'B'
(OFFICE)
PUBLIC CORRIDOR
2m
DEMISING
WALLS
TENANT 'C'
(DENTIST)
TENANT 'D'
(REAL ESTATE)

(A) 3 STOREY GROUP 'D' BUILDING


RETAIL
RETAIL
PUBLIC CORRIDOR
50m
DEMISING
WALLS
RETAIL
RETAIL
• 9 m Width
• 4m Height
• No occupancy

(B) 2 STOREY RETAIL MALL 50m x 72m FLOOR AREA

FIGURE 7-2

2. A public corridor in a sprinklered commercial mall is 9 m wide and complies with Sentence 3.3.1.4.(4)(b). What is the fire separation requirement between the tenant spaces that are occupied as business and personal service or mercantile occupancies.

______________________________ [______________]

No suite fire separations required by Sentence 3.3.1.1.(3)

3. In a sprinklered high-rise apartment building, what is the fire separation requirement between the public corridor and the dwelling units?

____

____

______________________________ [______________]

4. A public corridor serves a dwelling unit and four offices on the second floor of a two storey sprinklered commercial building. Each tenant space has 200 m^2. The building is regulated by Articles 3.2.2.56 and 3.2.2.46. What fire separation is required for the public corridor?

____

____

______________________________ [______________]

Fire Separations for Specific Major Occupancies

Assembly Occupancies

Article 3.3.2.5. of the Code commences with the general requirement that a corridor used by the public in an assembly occupancy must be separated from the remainder of the building by a fire separation having a 1 h FRR. This requirement is similar to other public corridor requirements, except:

- The fire separation can be reduced to 45 minutes if the FRR of the floor assemblies is allowed to be 45 minutes or less [Sentence 3.3.2.5.(2)].

- A fire separation with 0 h FRR is permitted if the floor area is sprinklered. (Note: a 0 h fire separation must function as a barrier to spread of fire and smoke, and doors in such a separation are still required to have a self-closer and latch, but need not be labeled) [Sentence 3.3.2.5.(3)].

- No fire separation at all is required if the travel distance from any point in the floor area to an exit, does not exceed 30 m in a floor area that is not sprinklered, and 45 m in a floor area that is sprinklered. The waiver for no fire separation at all is different from public corridors, as it is based on travel distance rather than the width of the corridor [Sentence 3.3.2.5.(4)].

Note: The waiver to the corridor separation does not waive the separation requirements as required elsewhere in the Code (For example: Sentence 3.3.2.2.(4) requires hazardous classrooms, in elementary or secondary schools, to be separated from the "remainder of the building").

Care and Detention Occupancies

These occupancies have unique requirements due to the specialized nature of their operation.

Walls between sleeping rooms and the remainder of the floor area in hospitals and nursing homes are not required to have a FRR but shall be constructed as fire separations [Sentence 3.3.3.5.(9)].

The requirements in Article 3.3.3.5. for hospitals and nursing homes are based on the understanding that staff will be in attendance at all times on each storey and in each (or adjacent) fire compartment.

A contained use area shall be separated from the remainder of the building by a 1 h fire separation [Sentence 3.3.3.7.(2)].

Except as noted below, a building with a contained use area shall be sprinklered [Sentence 3.3.3.7.(3)].

Sprinklers are not required if the contained use area is located in a building that is not required to be sprinklered by Articles 3.2.2.20. to 3.2.2.83. and:

- the contained use area and the remainder of the building are provided with a 2 h smoke concentration limit so that neither compartment will contain more than 1% by volume of contaminated air from a fire occurring in the other compartment;

- the building is designed to limit the concentration of smoke by volume to 1% of the contained use area from a fire occurring in another part of the building;

- all egress doors are designed to be remotely released as per Sentence 3.3.1.12.(6); and

- the contained use area does not contain any rooms lined with combustible padding [Clause 3.3.3.7.(4)(d)].

- A contained use area shall have no dead-end corridors unless areas served by the dead-end portion have a second and separate means of egress.

Fire Separations for Specific Uses

There are specific types of rooms or uses that the Code addresses individually. Janitors' rooms and common laundry rooms are addressed in the general requirements of Subsection 3.3.1. [Sentences 3.3.1.20.(1) and 3.3.1.21.(1)].

Other uses, such as rooms in theatres with seating for over 200 persons, auto repair shops in schools, contained use areas, patient rooms in hospitals and nursing homes, multi-storey dwelling units in a residential building, storage rooms in residential occupancies, repair garages and storage garages, are addressed under the major occupancy requirements in Subsections 3.3.2. to 3.3.5.

STOP

Exercise #7-2

Review Subsections 3.3.2. to 3.3.5. and answer the following questions.

1. What fire separation is required between a storage room within a dwelling unit and an adjacent bedroom?

   ______________________________[_______________]

2. What fire separation is required between a chemistry lab in a sprinklered secondary school and a corridor used by the public?

   ______________________________[_______________]

3. What fire separation is required between a parking garage and an adjacent garbage room in an apartment building?

   ______________________________[_______________]

4. What fire separation is required between a multi-purpose room in a sprinklered secondary school and a corridor used by the public, if the occupant load in the room is greater than 200 persons?

   ______________________________[_______________]

The following Table 7-1provides a summary of the fire separation requirements between different suites and rooms, with Code references.

TABLE 7-1

Minimum Required Fire Separation Rating Between Different Suites and Rooms

Room or Suite	Minimum Rating of Fire Separation		Code References
	Sprinklered	Unsprinklered	
1. Between any occupancy and A-1 major occupancy where occupant load exceeds 200 and floor rating is 1 h	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.2.2.(1) & (2) 3.1.3.2.(1)*
2. Between usable space under tiers of seats in an arena	0 h	45 min	3.3.2.2.(3)
3. Library book storage area greater than 250 m^2	0 h	2 h	3.3.2.11.(1)&(2)
4. Between a common laundry room in an apartment building and the rest of the floor area	0 h	1 h (45 min if floor not > 45 min	3.3.1.21.(1), (2) & (3)
5. Between separate residential apartments	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.1.1.(1) 3.3.4.2.(1) & (2)
6. Common storage rooms (not in a suite) on each floor of an apartment building where floor rating is 1 h	1 h (45 min if floor not > 45 min	prohibited	3.3.4.3.(1),(2) & (3)
7. Between stores in a strip plaza having a 45 min first floor fire separation	45 min	45 min	3.3.1.1.(2)
8. Between suites in multi-tenant industrial occupancies	1 h (45 min if floor not > 45 min	1 h (45 min if floor not > 45 min	3.3.1.1.(1) & (2)
9. Between repair garage and other non-ancillary occupancies	2 h	2 h	3.3.5.5.(1)
10. Between storage garage and other occupancies	1.5 h	1.5 h	3.3.5.6.(1)
11. Between a garbage room without chute and the remainder of the building	1 h	prohibited	3.6.2.5.(1)
12. Between a garbage room with chute and the remainder of the building	2 h	prohibited	3.6.3.3.(6) 3.6.3.3.(9)

* A, mix with F-1 prohibited

7.4 MEANS OF EGRESS AND EGRESS DOORWAYS

The terms means of egress, access to exits and exits are often confused. Further compounding the confusion are the undefined terms, egress doorway(s), points of egress, and egress facility, etc. The means of egress is the entire route from within a floor area to the exterior of the building, whereas, the access to exit is made up of the components of the route from within the floor area to an exit such as the egress door, corridor, ramps, stair, etc. that comprise the means of egress.

An exit is generally an exit stair shaft, a door to an exit stair shaft or to the exterior, or a door through a firewall leading to a separate building. It is important to remember that when the Code refers to an egress door, it is not necessarily referring to an exit door.

The primary function of both means of egress and access to exit is to ensure that occupants of a building are provided with a safe path of travel out of a room, floor area or building in any emergency condition. Subsection 3.3.1. outlines the requirements for providing one or more means of egress from rooms and suites of rooms within floor areas.

For a floor area that contains more than one suite, the access to exit from the room or suite shall be a doorway or doorways that:

- open directly to the exterior, or
- into a public corridor, or
- to an exterior passageway.

Except for dead-end corridors or where otherwise permitted by the Code, where the door enters the public corridor or exterior passage, it shall be possible to go in opposite directions to two separate exits.

Egress From Rooms or Suites

Article 3.3.1.5. specifies the requirements for egress doors from rooms or suites of rooms. Except for dwelling units, the general rule is that a minimum of two egress doors located remote from one another (the separation distance is not specifically regulated but there are rules of thumb that can be used) are required from every room or suite, based on the following criteria.

- The room or suite is more than 15 m^2 and is occupied as a high hazard industrial occupancy, or is a hazardous room.
- It is intended for an occupant load of more than 60 persons.
- In a floor area that is not sprinklered, the room or suite exceeds the area or the travel distance in Table 3.3.1.5.A .
- In a sprinklered floor area that is not an F-1 occupancy, the travel distance is more than 25 m, OR the area is greater than the value in Table 3.3.1.5.B.
- If the room is a hazardous classroom in an elementary or secondary school and exceeds 100 m^2 in area.

Table 3.3.1.5.A

Egress in Floor Area not Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or Suite	Maximum Area of Room or Suite, m^2	Maximum Distance to Egress Doorway, m
Group A	150	15
Group C	150 (1)	25 (1)
Group D	200	25
Group E	200	25
Group F, Division 2	200	25
Group F. Division 3	200	25

Note to Table 3.3.1.5.A: (1) See Article 3.3.4.4. for dwelling units

- In a floor area that is sprinklered, the room or suite is greater than the area in Table 3.3.1.5.B, or the travel distance to an egress door exceeds 25 m.

Table 3.3.1.5.B

Egress in Floor Area Sprinklered Throughout
Forming Part of Sentence 3.3.1.5.(1)

Occupancy of Room or Suite	Maximum Area of Room or Suite, m^2	Maximum Travel Distance, m
Group A	200	25
Group B, Division 1	100	25
Group B, Division 2		
sleeping rooms	100	25
other than sleeping rooms	200	25
Group C	150 [1]	25
Group D	300	25
Group E	200	25
Group F, Division 2	200	25
Group F. Division 3	300	25

Notes to Table 3.3.1.5.B:
[1] See Article 3.3.4.4. for dwelling units

Note: Where more than one egress door is required from a room or suite, the travel distance to the nearest door shall not exceed the travel distances specified in Clauses 3.4.2.5.(1)(a), (b), (c) and (f) for exits [3.3.1.6.(1)]. The 25 m requirement for determining the need for the additional exit does not govern.

Egress From Mezzanines

There are specific egress requirements for mezzanines that are similar but different from the general requirement for rooms or suites [Sentences 3.3.1.5.(2) and (3)].

Except for mezzanines within dwelling units, these requirements apply to mezzanines that are not required to terminate at a vertical fire separation [Article 3.2.8.2.].

Two egress facilities located remote from one another are required from mezzanines that:

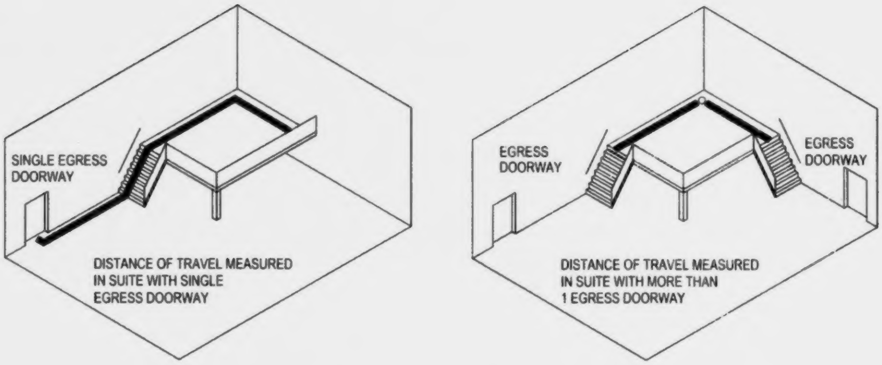
- serve a Group F, Division 1 major occupancy,
- contain an occupant load of more than 60 persons,
- in a floor area that is not sprinkered, exceed the area or travel distance requirements in Table 3.3.1.5.A, or
- in a floor area that is sprinkered, exceed the area requirements in Table 3.3.1.5.B, **or** the travel distance exceeds 25 m [Sentence 3.3.1.5.(2)].

The travel distance is measured from any point on the mezzanine to the egress door of the room in which it is located, where the room is permitted to have a single egress door (see Figure 7-3 (a)), and to the top of the stair serving the mezzanine (see Figure 7-3 (b)) where the room in which it is located is required to have more than one egress door [Sentence 3.3.1.5.(3)].

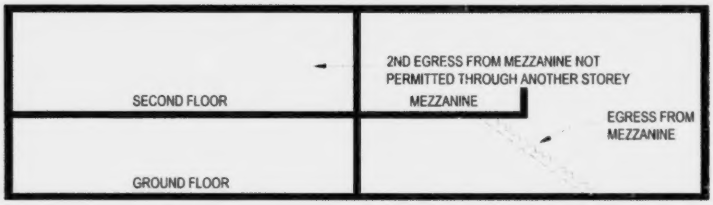
Egress from Dwelling Units

There are specific requirements for egress from dwelling units. These requirements are outlined in Article 3.3.4.4.

A dwelling unit is permitted to have a single exit door regardless of size or travel distance, provided that the exit door is an exterior door located not more than 1500 mm above grade, and it is not necessary to travel up or down more than one storey to reach the exit door, or the uppermost storey has a balcony not more than 6 m above the adjacent ground level [Sentence 3.3.4.4.(3)].


SINGLE EGRESS DOORWAY
DISTANCE OF TRAVEL MEASURED IN SUITE WITH SINGLE EGRESS DOORWAY
EGRESS DOORWAY
EGRESS DOORWAY
DISTANCE OF TRAVEL MEASURED IN SUITE WITH MORE THAN 1 EGRESS DOORWAY

(a) SINGLE EGRESS DOOR FROM ROOM (b) TWO EGRESS DOORS FROM ROOM


2ND EGRESS FROM MEZZANINE NOT PERMITTED THROUGH ANOTHER STOREY
SECOND FLOOR
MEZZANINE
EGRESS FROM MEZZANINE
GROUND FLOOR

(c)

FIGURE 7-3

Where a single storey dwelling unit does not have access to a public corridor or exterior passageway on the same storey, it shall be served by a private stairway (i.e. located within the dwelling unit) leading directly to a public access to exit (i.e. generally a public corridor) on the storey immediately above and immediately below [Sentence 3.3.4.4.(1)].

For dwelling units containing more than one storey, except as noted below, an exit door or egress door opening into a public access to exit is required serving the uppermost storey and the lowest storey so that each storey is served by an egress door located not more than 1500 mm above or below its floor level [Sentence 3.3.4.4.(2)].

The exceptions to the two egress door requirements for multi-level dwelling units are outlined in Sentences 3.3.4.4.(4) and (5).

Egress From Special Areas

Article 3.3.1.3. contains the egress requirements for specialized areas such as occupied roof spaces, terraces or podiums, rooftop enclosures, service rooms and service space.

Roofs, terraces or podiums that are accessible or occupied by the general public have requirements for egress similar to rooms within the building. Where the occupant load exceeds 60 persons, two separate means of egress are required to stairs designed to meet the exit stair requirements in Section 3.4 [Sentence 3.3.1.3.(4)].

For rooftop enclosures, mechanical penthouses, service spaces or service rooms, two means of egress or points of egress are required if the room exceeds 200 m^2 in area or the travel distance exceeds 25 m to the point of egress. Sentence 3.3.1.13.(2) permits ramps and stairways that do not conform to the requirements of Sentence 3.3.1.13.(1), to serve service rooms and service spaces and in industrial occupancies.

EXERCISE #7-3

1. An office suite in a Group D sprinklered building has an area of 280 m^2. The travel distance from a remote point in the suite has a travel distance of 30 m to the public corridor entrance to the suite. A single egress door is permitted from this suite. True or false? Explain

   ____

   ______________________________[_______________]

2. A mechanical penthouse on the roof of a sprinklered building has an area of 200 m^2. A single exit stair may provide the only access to the penthouse if the travel distance from any point in the penthouse to the exit door does not exceed 50 m as permitted by Sentence 3.4.2.4.(3). True or False? Explain.

   ____

   ______________________________[_______________]

3. A mezzanine in a Group F2 occupancy is not required to terminate at a vertical fire separation by Subsection 3.2.8 and has an area of 200 m^2 in a sprinklered floor area. The travel distance from any point on the mezzanine to the top of the stair providing egress from the mezzanine is 25 m. The suite in which the mezzanine is located has an area of 600 m^2. The single stair serving the mezzanine is acceptable. True or False? Explain.

   ____

   ______________________________[_______________]

4. How many egress doors are required from a hazardous classroom in a sprinklered secondary school if the classroom has an area of 150 m^2 and the room measures 10 m by 15 m.

____

_________________________[_____________]

5. In a sprinklered office building, a tenant has a suite with an area of 320 m^2 and has two egress doorways. What is the maximum travel distance from any point in the suite to the nearest egress doorway?

____

_________________________[_____________]

STOP

7.5 DESIGN CRITERIA FOR DOORS, CORRIDORS, GUARDS, AISLES

DOORS

Door Swing

Except for sliding doors or partitions permitted by Article 3.3.1.11., all required egress doors shall swing on a vertical axis [Sentence 3.3.1.10.(1)].

Doors from rooms or suites shall swing in the direction of travel where:

- the occupant load of the room or suite is more than 60,
- it serves a high hazard industrial occupancy, or
- it serves a hazardous classroom in an elementary or secondary school [Sentence 3.3.1.10.(2)].

Every door that divides a public corridor or corridor used by the public shall swing on a vertical axis in the direction of egress where the corridor provides access to exit:

- where the occupant load of the room or suite is more than 60,
- for a high hazard industrial occupancy,
- for a hazardous classroom in an elementary or secondary school, or
- for a Group B, Division 2 or 3 occupancy [Sentence 3.3.1.10.(3)].

Where double doors are used in a corridor that provides access to exit in both directions, the doors shall swing in opposite directions with the door on the right swinging in the direction of egress [Sentence 3.3.1.10.(4)].

Sliding doors are permitted in the locations mentioned in Article 3.3.1.10. provided they can swing on a vertical axis in the direction of egress when pressure is applied. These doors shall be suitably identified as a swinging door with a sign affixed to the door. The swing open feature shall be functional regardless of the location of the door in the slide guides [Sentence 3.3.1.11.(1)].

Moveable partitions may be used as egress doors in business and personal service occupancies and in mercantile occupancies, provided they are not the only means of egress from the room or suite and no fire separation is required for the public corridor [Sentence 3.3.1.11.(3)].

Door Size and Hardware

A door that provides access to exit from a room or suite into a public corridor or is located within a public corridor shall have a minimum clear opening width of 800 mm. (Read Article 3.3.1.12. for all criteria.) Doors in a barrier-free path of travel require a minimum clear width of 850 mm [Sentence 3.8.3.3.(1)].

B1 and B2 occupancies have different minimum door widths of 1100 mm or 1050 mm, as per Sentences 3.3.3.3.(4) and 3.3.3.4.(1).

A door in an access to exit must be readily openable in the direction of egress without requiring keys or special devices, or specialized knowledge of the door opening mechanism. Electromagnetic locking devices where permitted elsewhere in the Code are deemed to comply with this requirement [Sentences 3.3.1.12.(2) and 3.3.1.12.(10)].

Except for dwelling units or other suites of residential occupancy (e.g. hotel/motel) the door release hardware shall be operable by one hand and the door shall be openable with not more than one releasing operation [Sentence 3.3.1.12.(3)].

The door release hardware shall be located not more than 1200 mm above the floor surface [Sentence 3.3.1.12.(5)].

Glazing in Doors and Sidelights

The Code recognizes that there is a potential hazard created by glazing in doors, sidelights and partitions where occupants are not aware of the glazing or can mistake a glazed sidelight or partition as a doorway opening. Glass doors shall be laminated or tempered safety glass or wired safety glass [Sentence 3.3.1.18.(1)].

Glazing in doors is limited by type of glass, area of glazing and glass thickness in accordance with Article 9.6.6.2. in Part 9 of the Code [Sentence 3.3.1.18.(5)].

Glass in partitions or sidelights in access to exits that could be mistaken as a means of egress shall be made inaccessible by barriers or railings [Sentence 3.3.1.18.(3)].

CORRIDORS

The minimum width of every public corridor is 1100 mm. Corridors in B1, B2 and B3 occupancies may require wider widths in accordance with Article 3.3.3.3. unless governed by Clause 3.3.1.9.(2)(c).

Obstructions within corridors to protect visually impaired persons are regulated by Sentences 3.3.1.9.(3) and (4) (see Figure 7-4).

The Code permits an occupancy within a public corridor, corridor used by the public or other corridor providing access to exit, provided it does not reduce the unobstructed width of the corridor to less than the minimum width required for exit purposes [Sentence. 3.3.1.9.(5)].

The corridor serving patients in hospitals shall be a minimum of 2400 mm wide to accommodate stretchers [Sentence 3.3.3.3.(2)].

The corridor serving residents in Group B, Division 2 or 3 occupancies shall be not less than 1650 mm wide except as permitted by Clause 3.3.1.9.(2)(c) [Sentence 3.3.3.3.(3)].

The clear width of doorways serving patients or residents rooms shall be not less than 1050 mm [Sentence 3.3.3.4.(1)].

Limit of Obstruction in Corridors

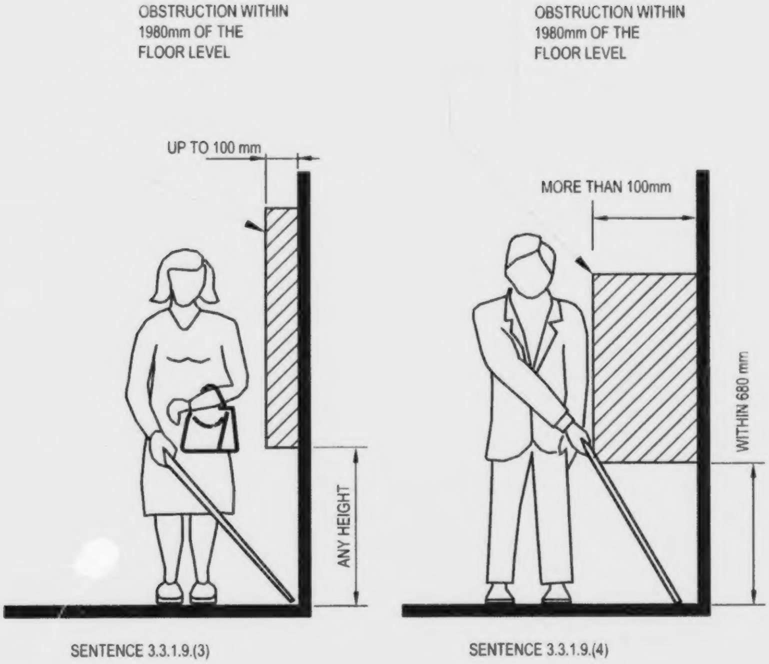

OBSTRUCTION WITHIN
1980mm OF THE
FLOOR LEVEL
UP TO 100 mm
ANY HEIGHT
SENTENCE 3.3.1.9.(3)
OBSTRUCTION WITHIN
1980mm OF THE
FLOOR LEVEL
MORE THAN 100mm
WITHIN 680 mm
SENTENCE 3.3.1.9.(4)

FIGURE 7-4

Occupancies such as kiosks are permitted in public corridors conforming to Sentence 3.3.1.4.(4) and Clause 3.4.2.5.(1)(d), provided they maintain an unobstructed width of 3 m between the kiosk and adjacent suites that front onto the public corridor. The combined area of all occupancies in the public corridor cannot exceed 15% of the area of the public corridor [Sentence 3.3.1.9.(6)].

Aisles shall be provided in conformance with the Fire Code made under the Fire Protection and Prevention Act, 1997 [Sentence 3.3.1.9.(15)].

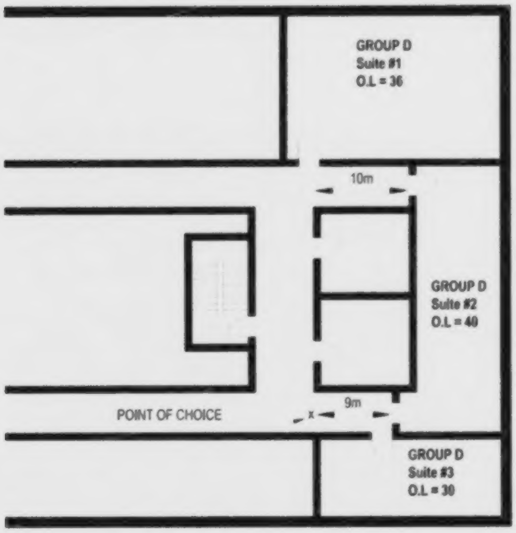
Dead-end Corridors

When a corridor is used as an access to exit, the Code generally requires that from the point where a person enters the corridor, there has to be a choice of direction to at least two separate exits. However, under certain conditions the Code permits an exception to this rule and allows the path of travel or a portion of the path of travel to be in a single direction. The condition is referred to as a dead-end corridor. This is not a defined term.

A dead-end corridor is that portion of the corridor measured from the end of the corridor (not from where a door enters the corridor) to an exit or to a point in the corridor where there is a choice to two separate exits. There are two hazards created by dead-end corridors. There is a hazard to the occupants of the rooms served by the dead-end, but there is also the hazard of people using the main corridor and entering the dead-end portion not realizing that the corridor does not lead to an exit. They would therefore have to retrace their path to the main corridor, thereby increasing their travel distance (in effect increasing their evacuation time) (see Figure 7-5).

The Code has different dead-end requirements based on the occupancy served by the dead-end. Read Sentences 3.3.1.9.(7) to (14) and see the attached Table 7-2 for the various requirements. Note that the Group D, E, F-2 and F-3 occupancies allow the option of a maximum length of dead-end of 9 m, or no maximum length, if the rooms or suites served have a second and separate egress doorway not leading into a dead-end.

Typical Dead-End Corridor Serving Suites


GROUP D
Suite #1
O.L = 36
10m
GROUP D
Suite #2
O.L = 40
POINT OF CHOICE
x
9m
GROUP D
Suite #3
O.L = 30

-O.L denotes occupant load.
-Suite #1: Ok [3.3.1.3.(9)]. Suite #1 not in dead-end.
-Suite #2: Not allowed [3.3.1.9.(11)(b)]. Suite #2 has two egress doors in separate dead-end corridors.
-Suite #3: Ok [3.3.1.9.(11)(a)]. Suite #3 has dead-end not more than 9m and O.L not greater than 30 persons

FIGURE 7-5

TABLE 7-2

Conditions for Permitting Dead-End Corridors

Code Reference	Occupancy	Length Restrictions (in Article 3.3.1.9)	Conditions
3.3.1.9.(8)	A	none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.3.3.(1)	B	no requirement	Area served by a dead-end portion needs a second, independent means of egress.
3.3.1.9.(9) 3.3.1.9.(10)	C	maximum, 6 m	No limit on number of suites, but corridor cannot have doors opening into service or hazardous rooms.
3.3.1.9.(11)	D	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(12)	E	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(14)	F-1	none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.
3.3.1.9.(13)	F-2 & F-3	maximum, 9 m	Serves maximum occupant load of 30. Doors require self-closing devices.
		or none	Provide a second, independent egress doorway from each room/suite not leading into a dead-end corridor.

STOP

GUARDS - GENERAL

Article 3.3.1.17. provides the general requirement for guards to prevent accidental falls from one level to another. Guards are generally required where the difference in elevation exceeds 600 mm.

A *guard* means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such a barrier may or may not have openings through it.

There are four basic criteria that apply to guards:

- There is a minimum height for a guard based on its intended use. The general minimum height of a guard is 1070 mm above the floor surface. However, there are exceptions to the general rule for specific applications. Where a handrail on an exit stair also acts as a guard, it shall be not less than 865 mm or more than 965 mm in height above the tread at the nosing [Sentences 3.4.6.4.(4) and 3.4.6.5.(2)]. In assembly occupancies, the guards in fixed seating areas such as balconies, galleries, boxes, etc. are permitted a lower height to accommodate sight lines. Guards are not required at the front of stages, floor pits in repair garages and loading docks [Sentence 3.3.1.17.(6)].
- There is a restriction on the opening through a guard to prevent a small child from falling through, or getting their head stuck in the opening [Sentences 3.3.1.17.(2), (3) and (4)].
- There is a restriction on the guard configuration to prevent a guard from being climbable [Sentences 3.3.1.17.(5)].
- There is a strength criterion for a guard to ensure that it can withstand the lateral loads imposed on the guard [Article 4.1.5.15.].

Guards in Assembly Occupancies

Article 3.3.2.8. has specific requirements that apply to guards in both indoor and outdoor assembly occupancies with fixed seating.

These requirements differ from the general requirements that apply to guards in other locations. They have been developed specifically to prevent accidental falls while accounting for the need to provide acceptable sight lines with minimal obstructions.

The height of guards in front of seats at the fascia of every box, balcony or gallery shall be not less than 760 mm [Subclause 3.3.2.8.(1)(a)(i)].

The height of guards at the end of aisles, or at the foot of steps in an aisle, shall be not less than 920 mm [Subclause 3.3.2.8.(1)(a)(ii)].

The height of guards along cross aisles shall be not less than 660 mm, except where the seats along the front of the aisle extend not less than 600 mm above the floor of the aisle, no guard is required [Clause 3.3.2.8.(1)(b)].

Where seating is arranged in successive tiers that exceed 450 mm between platforms, the height of guards along the front of the platforms shall not be less than 660 mm [Clause 3.3.2.8.(1)(c)].

STOP

EXERCISE #7-4

Review Subsections 3.3.2. and 3.3.3., and Section 3.8.

1. A classroom in a secondary school has a total occupant load of 60 persons. The room has a single egress door. The door may swing into the classroom. True or False?

   ____

   ____________________ [__________]

2. A classroom in a school is located in a dead-end corridor. The occupant load in the classroom is not more than 60 persons. Under what conditions is this egress arrangement permissible?

   ____

   ____

   ____________________ [__________]

3. What is the minimum clear opening width of a doorway serving a meeting room in a school? The room has a single means of egress and can accommodate up to 30 persons.

   ____

   ____

   ____________________ [__________]

4. A client wishes to install an electromagnetic locking device (EMLD) on a door to a computer room in an office building. The room is permitted to have a single egress door and will have an occupant load of 15 persons. The EMLD will be installed in accordance with Sentence 3.4.6.15.(4) and may be unlocked by the activation of a

pull station located on the room side of the door. Is this locking device permitted, or does it contravene Sentences 3.3.1.12.(2) and (3)?

____

____________________ [__________]

5. A dead-end corridor serves two Group F2 industrial tenants on the ground floor of a 6 storey sprinklered building. Each tenant space has an exit door that opens directly to the exterior. The corridor is separated from each tenant space by a 1 h fire separation. Is there a maximum length for this corridor to serve as a second means of egress?

____

____

____________________ [__________]

6. What is the minimum height of a guard at the foot of a stepped aisle serving a balcony in a theatre?

____________________ [__________]

STOP

7.6 SPECIAL REQUIREMENTS

Protection on Floor Areas with a Barrier-Free Path of Travel

Article 3.3.1.7. provides requirements to ensure that persons with physical disabilities are provided with additional measures in fire or other life threatening emergencies to compensate for their inability to evacuate a building through the normal means of exit stairs. These requirements apply to storeys above or below the first storey in buildings that are not sprinklered.

Clause 3.3.1.7.(1)(a) permits an elevator that is designed similar to a firefighters' elevator in high-rise buildings as one acceptable option. This elevator must be accessible via a public corridor or vestibule that is separated from the remainder of the building by a 1 h or ¾ h fire separation as required by Clause 3.2.6.9.(3)(b) or (c).

The elevator shaft must be pressurized if the building is over 3 storeys in building height and is not sprinklered [3.3.1.7.(1)(a)(iii) and 3.3.1.7.(3)].

Another option is to create at least two zones to act as areas of refuge. The travel distance from any point in one zone to another zone must comply with the travel distance requirements for exits and each zone must contain a barrier-free path of travel to an exit.

The final option available only to residential occupancies is to provide a barrier-free accessible balcony in each dwelling unit. There are minimum dimensions for the balcony and the access to the balcony is restricted to a 13 mm high projection above the walking surface by being provided with a clear width of not less than 800 mm when the door is in the open position, and not less than 1500 mm deep from the outside exterior wall to the edge of the balcony, and have a minimum area of 0.5 m^2 for each occupant of the suite [Sentence 3.3.1.7.(7)].

STOP

Special Requirements for Major Occupancies

Earlier in this module, specific fire separation requirements for different major occupancies were addressed.

In this portion of the module, other special requirements that are unique to various major occupancies will be addressed.

When dealing with a specific major occupancy, one should always check the requirements in Subsections 3.3.2. to 3.3.5. for special rules that may apply. These Subsections are a catch-all for Code requirements that do not fit in with the major Code subjects like fire separations, exits, construction, etc.

Subsection 3.3.2. - Assembly Occupancies

These occupancies can contain large occupant loads often in fixed seating arrangements for viewing public performances. This Subsection of the Code contains the requirements that apply to the seating arrangements, aisles, corridors, exits, stages, guards, occupant loads, etc. that are unique to these occupancies.

Articles 3.3.2.3. and 3.3.2.4. specify the requirements that apply to rows and aisles for fixed seating in assembly occupancies.

The general requirements are as follows:

- Where fixed seats are arranged in rows in assembly occupancies, the minimum distance between the back of the seat in one row and the furthest projection of the seat in the next row, shall be 400 mm with the seat in the unoccupied position [3.3.2.3.(1)(c)].

- For fixed seats with backs there shall be not more than 7 seats between any seat and the nearest aisle (i.e. 16 seats in a row served by two aisles, 8 seats in a row served by one aisle) [3.3.2.3.(2)(a)].

- For bench type seating there shall be not more than 20 seats between any seat and the nearest aisle [3.3.2.3.(3)].

- The minimum clear width of an aisle serving seats on both sides shall be1100 mm [3.3.2.3.(5)].

- The minimum width of an aisle serving seats on one side shall be 900 mm [3.3.2.3.(5)(b)].

- The minimum width of any aisle serving not more than 60 persons is permitted to be 750 mm [3.3.2.3.(5)(a)].

- A dead-end aisle shall be not more than 6 m long [3.3.2.3.(12)].

Read Articles 3.3.2.3 and 3.3.2.4. for additional requirements and the exceptions to all of the above basic requirements.

Subsection 3.3.3. - Care and Detention Occupancies

In addition to the fire separation requirements previously mentioned in this module, there are special requirements to compartment floor areas in hospitals and nursing homes to act as areas of refuge in emergencies, as it may not be practical to evacuate occupants that are not ambulatory or are in a fragile condition.

There are also special fire separation and smoke control measures for special care and treatment facilities like operating rooms, intensive care rooms and critical care units.

The doors to sleeping rooms in these occupancies are permitted to be equipped with roller latches [Sentence 3.3.3.5.(11)].

Subsection 3.3.4. - Residential Occupancies

There are special egress requirements for residential occupancies in this Subsection. Article 3.3.4.4 describes egress requirements for units.

This Subsection also contains sound transmission rating restrictions for residential occupancies.

Subsection 3.3.5. - Industrial Occupancies

This Subsection provides a cross reference to the Ontario Fire Code and the National Fire Code of Canada for industrial occupancies that may be governed by these regulations or acts.

This Subsection also contains specific requirements for ventilation, curbs and vestibules for garages. There is a minimum size for the vestibules and the vestibules shall be vented naturally or mechanically.

Basements in industrial occupancies cannot be used for the storage, manufacture or handling of volatile solids, liquids or gases that generate explosive air/vapour mixtures or for processes that involve explosive dusts [3.3.5.3.(1)].

Where such processes occur above grade, entrances and exits to basements and rooms containing building services shall be fire separated from the remainder of the building and the separations shall be vapour-tight [3.3.5.3.(2)].

STOP

EXERCISE #7-5

1. What is the minimum size of a balcony in a 3 bedroom dwelling unit for compliance as an area of refuge under Article 3.3.1.7. for protection of floor areas in a barrier-free path of travel?

____

____

______________________ [____________]

2. What is the minimum height of a guard in the front of seats in the balcony of a theatre?

______________________ [____________]

3. What is the maximum length of a dead-end aisle in a classroom with fixed seats if the classroom is not separated from adjacent classrooms or the corridor used by the public?

______________________ [____________]

4. What fire separation is required between a kitchen and a servery in a sprinklered secondary school cafeteria with seating for 250 students?

______________________ [____________]

5. Consider a three storey building of residential occupancy. Two dwelling units on each of the 2nd and 3rd floors exit directly into the exit stair shaft. If each dwelling unit has access to another access to exit, is this permitted?

______________________ [____________]

6. What row spacing is required in a theatre that has two aisles with 30 seats between the aisles?

____

______________________ [____________]

7. A lecture hall in a university building has theatre type seating on stepped rows. What height above the back row of seating must the ceiling be, if the dead-end aisle serving the row is 10 m long?

   ______________________________ [________________]

8. The riser of a step in an aisle in an assembly occupancy may be not less than 125 mm high. True or False?

   ______________________________ [________________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 8

LARGE BUILDINGS - 2006

EXITS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

8.1 INTRODUCTION

EXIT is defined in the Building Code as "that part of a means of egress, including doorways, that leads from the floor area it serves, to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare".

This module will concentrate on requirements in the Building Code for the design and construction of exit facilities.

This module will include a list of defined terms relating to the content in this module. For a complete list of definitions, refer to Division A, Part 1, Article 1.4.1.2.

Objectives

Upon completion of this module, you will be able to:

- Provide an understanding of the code intent and application of exit requirements in the Code.
- Relate the basis for the factors that regulate the design of exits and exit systems.
- Demonstrate comprehension of applicable Code requirements through the use of 'exercises'.
- Identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.
- Identify the relevant sections located in the Code required to complete an exit analysis of a floor area (occupant load calculations 3.1.17.).

- Calculate required minimum exit widths and number of exit stairs/doors needed in buildings.

- Explain the differences in the requirements for exiting, based on building size and occupancy.

8.2 OVERVIEW

Read to next STOP sign.

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1, Article 1.4.1.2. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text.

Access to exit
Access to exit means part of a means of egress within a floor area that provides access to an exit serving the floor area.

Exit
Exit means that part of a means of egress, including doorways, that leads from the floor area it serves, to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare.

Fire-resistance rating
Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criterion or as determined by extension or interpretation of information derived from that test as prescribed in this Code.

Fire separation
Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Floor area

Floor area means the space on any storey of a building between exterior walls and required firewalls, including the space occupied by interior walls and partitions, but not including exits, vertical service spaces, and their enclosing assemblies.

Guard

Guard means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such barrier may or may not have openings through it.

Horizontal exit

Horizontal exit means an exit from one building to another by means of a doorway, vestibule, walkway, bridge or balcony.

Means of egress

Means of egress means a continuous path of travel provided for the escape of persons from any point in a building or contained open spaces to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare. Means of egress includes exits and access to exits.

Occupancy

Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Occupant load

Occupant load means the number of persons for which a building or part thereof is designed.

Public corridor

Public corridor means a corridor that provides access to exit from more than one suite.

Suite

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories, as well as individual stores and individual or complementary rooms for business and personal services occupancies.

General Overview

Exits are one of the most important life safety systems. An exit is a passive fire protection system. An exit provides occupants with a substantial level of protection from exposure to a fire within a floor area, and from lower floor areas that would have to be passed while using the exit.

Exits, in one form or another, are a fundamental fire protection measure that apply to all buildings.

The Building Code, therefore, dictates strict requirements for the protection of exits to make them accessible to occupants of all occupied floor areas and to limit penetrations into the exit.

In general, most buildings are required to have at least two separate exits. Provision of multiple exits allows alternate means of escape in the event one exit cannot be utilized as a result of fire.

Designers, architects and engineers are encouraged to review the building code requirements for exits, as they will have architectural, structural, mechanical and electrical implications.

STOP

8.3 GENERAL REQUIREMENTS

Exit facilities are required for every floor area intended for occupancy.

Take 15 minutes to read Subsection 3.4.1. and answer the following questions. Provide Code references with answers where applicable.

EXERCISE #8-1

1. The cumulative capacity of two converging exits serving a floor area cannot exceed . . .

   ______________________________ [________________]

2. Which of the following is not considered an exit?

   a) interior stairway

   b) elevator

   c) exterior ramp

   d) exterior doorway

   e) interior passageway

   ______________________________ [________________]

3. Exterior exit passageways may be accessed through operable exterior windows. True or false?

   ____

   ______________________________ [________________]

4. Why must exits be kept separate from one another when more than one exit is required?

____

____

5. Summarize the general requirements for glass doors in an exit.

____

____

__________________________[_____________]

____

____

__________________________[_____________]

STOP

8.4 NUMBER AND LOCATION OF EXITS

Required number and location of exits are dealt with in Subsection 3.4.2.

Generally, a floor area is required to have at least two exits. As a general rule, the more remote one exit is from another, the less likely both exits will be inaccessible during an emergency.

However, Sentence 3.4.2.1.(2) permits a single exit from a floor area under the following conditions:

- the building is not more than two (2) storeys in building height
- the total occupant load served by the exit does not exceed 60 persons, and
- in a floor area that is not sprinklered, the floor area and the travel distance are not more than the values in Table 3.4.2.1.A, or
- in a floor area that is sprinklered,
    - the travel distance is not more than 25 m, and
    - the floor area is not more than the value in Table 3.4.2.1.B.

Ideally, exits should be located at opposite ends of a building. Article 3.4.2.3. provides a quantitative method of determining a minimum safe separation distance between exits in a floor area. To regulate the least distance allowable between the two exits, Article 3.4.2.3. treats the distance between separation of exits in terms of whether the floor area:

- is an open floor area
- has a public corridor
- is divided by a fire separation subdividing the floor area.

When access to exit is through a public corridor, the minimum distance between exits is reduced. The public corridor provides a space separated from the remainder of the floor area and from the exits with fire separations such that the likelihood of fire within the floor area affecting two exits simultaneously is reduced.

If a fire separation is not required but is provided in order to negate the regulations regarding minimum distance between exists, building inspectors must ensure that the fire separations are properly constructed and that any penetrations are dealt with.

Floor plans illustrating minimum distance between exits are shown in Figure 8-1.

Take 15 minutes to complete Exercise #8-2.

EXERCISE #8-2

Read Articles 3.4.2.1. and 3.4.2.3. and answer the questions that follow.

1. The floor area of an office building is not subdivided by a fire separation or provided with a public corridor. The maximum diagonal dimension of the floor area is 54 m. What is the required minimum exit separation distance?

   ______________________________[______________]

2. A residential apartment building floor area is constructed with multiple dwelling units served by a public corridor with exits at either end. The maximum diagonal dimension of the floor area is 38 m. What is the required minimum exit separation distance?

   ______________________________[______________]

3. Consider a two storey unsprinklered retail building having a building area of 170 m^2. One exit serves both the first and second floors. The occupant load is 46 persons on the first floor and 30 persons on the second floor. Maximum travel distance to an exit is 22 m. Does the Code permit a single exit from the building? Explain.

   ____

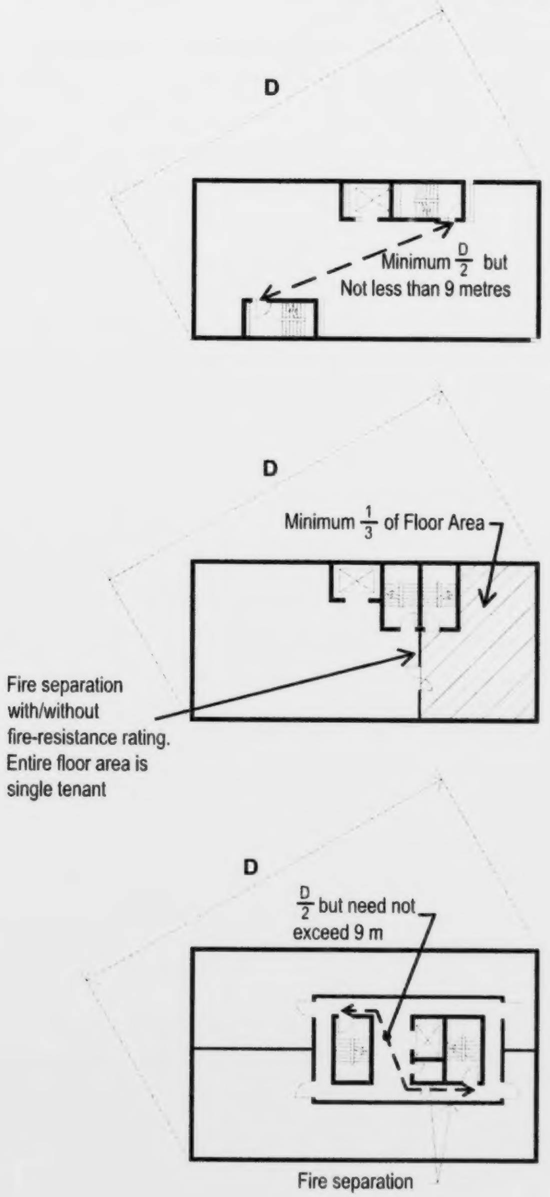
   ____

   ______________________________[______________]

STOP

Minimum Distance Exits

DRAWING 8-1: MINIMUM DISTANCE BETWEEN


D
Minimum $\frac{D}{2}$ but
Not less than 9 metres
D
Minimum $\frac{1}{3}$ of Floor Area
Fire separation with/without fire-resistance rating. Entire floor area is single tenant
D
$\frac{D}{2}$ but need not exceed 9 m
Fire separation

Withou. t public corridor and without passing through a fire separation when travelling from one exit to another.

Minimum distance between exits is not regulated.

With public corridor and without passing through a fire separation when travelling from one exit to another.

FIGURE 8-1

8.5 TRAVEL DISTANCE

Travel distance is regulated by Articles 3.4.2.4. and 3.4.2.5.

One of the predominant factors in determining the number of exits required from a floor area is the travel distance. By putting an upper limit on travel distance to an exit, the Code reduces the hazard to occupants. The measurement of travel distance is therefore important.

For the purpose of Subsection 3.4.2., travel distance is the distance measured along the path of travel to an exit from any point within a floor area. It must be measured along the line of pedestrian movement. In rooms or floor areas where the configuration of the occupied space cannot be established accurately, a perimeter measurement of travel distance should provide a reasonable allowance for such obstructions (Figure 8-2 (a)).

Where a room or suite is served by an exterior passageway or by a corridor separated from the remainder of the floor area by a fire separation, the travel distance can be measured from the egress door of the room or suite to the nearest exit (Figure 8-2 (b)).

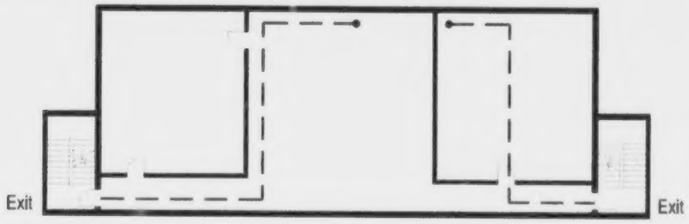
Where travel distance is permitted to be measured from the room or suite egress door to an exit, additional travel distance within the room or suite is regulated by Article 3.3.1.5. for rooms or suites with one egress doorway and Article 3.3.1.6. for rooms or suites having more than one egress doorway (Figure 8-2 (b)).

Maximum permitted travel distances vary based on major occupancy and presence of sprinklers. Travel distance is also influenced by whether one, or more, exits are required. Table 8.1 summarizes requirements of Articles 3.4.2.1., 3.4.2.4. and 3.4.2.5.

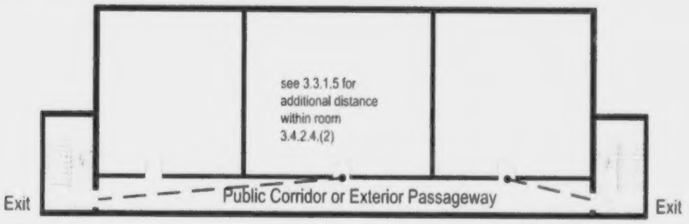
At least one door at every principal entrance should be designed as an exit for the purposes of Section 3.4 [Sentence 3.4.2.6.].

Travel Distance

a) Travel Distance Without Fire Separated Corridor 3.4.2.4.(1)



b) Travel Distance Along a Fire Separated Corridor


see 3.3.1.5 for additional distance within room 3.4.2.4.(2)
Public Corridor or Exterior Passageway
Exit
Exit

c) Travel Distance Permitted By 3.4.2.5.(1)(d)
(Sprinklered)

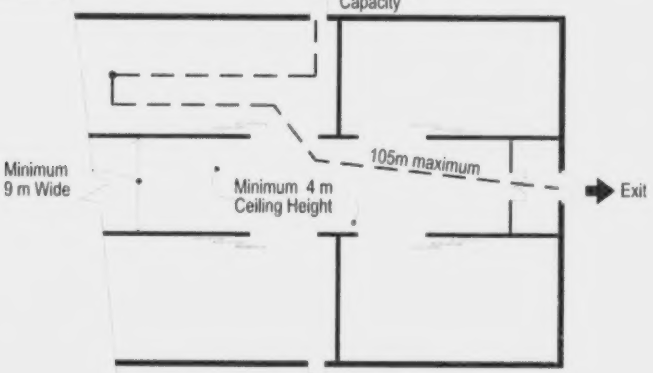

Minimum $\frac{1}{2}$ Capacity
105m maximum
Minimum 9 m Wide
Minimum 4 m Ceiling Height
Exit

FIGURE 8-2

TABLE 8-1

Maximum Travel Distance in Metres

Use/ Occ.	More than One Exit Required from a Floor Area Max. TD to at least 1 Exit‡ [3.4.2.5.]		One Exit from a Floor Area Permitted (Two Storeys or Less) (Occupant Load $\leq$ 60) [3.4.2.1.]		
	Not Sprinklered	Sprinklered Floor Area	Not Sprinklered		Sprinklered Floor Area
			Maximum Travel Distance	Maximum Area (m^2)	Maximum Area (m^2) (Travel Distance $\leq$ 25 m)
AOFS	45 m	45 m	15 m	150 m^2	200 m^2
A-1	30 m	45 m	15 m	150 m^2	200 m^2
A-2	30 m	45 m	15 m	150 m^2	200 m^2
A-3	30 m	45 m	15 m	150 m^2	200 m^2
A-4	30 m	45 m	15 m	150 m^2	200 m^2
B-1	30 m	45 m	†	†	100 m^2
B-2	30 m	45 m	†	†	100 m^2
B-3	30 m	45 m	†	†	100 m^2
C	30 m	45 m	15 m	100 m^2	150 m^2
D	40 m	45 m	25 m	200 m^2	300 m^2
E	30 m	45 m	15 m	150 m^2	200 m^2
F-1	25 m	25 m	#	#	#
F-2	30 m	45 m	10 m	150 m^2	200 m^2
F-3	30 m*	45 m*	15 m	200 m^2	300 m^2
9 m PC	30 m	105 **	#	#	#

TD	travel distance
*	TD = 60 m for an open air storage garage
AOFS	assembly occupancy with fixed seats complying with 3.3.2.4.(15) and (16)
**	building is sprinklered
9m PC	9 m wide public corridor
†	see 3.4.2.1.(3)
‡	or provide exits spaced at 60 m along building perimeter, except F-1
#	not permitted

NOTES:

Take 15 minutes to complete Exercise #8-3.

EXERCISE #8-3

Using Articles 3.4.2.4. and 3.4.2.5., answer the following questions.

1. Travel distance may be measured from an egress door of a room or suite to the nearest exit in specific circumstances. Which of the following conditions does not allow travel distance measurement from a room or suite egress door?

   a) When the room or suite is served by an exterior passageway.
   b) When the room or suite is served by a public corridor that is separated from the remainder of the floor area by a fire separation
   c) When the room or suite is served by a corridor used by the public that is separated from the remainder of the floor area by a fire separation.
   d) When the room or suite is not separated from the remainder of the floor area by a fire separation.

2. Identify the maximum travel distances permitted in the following circumstances:

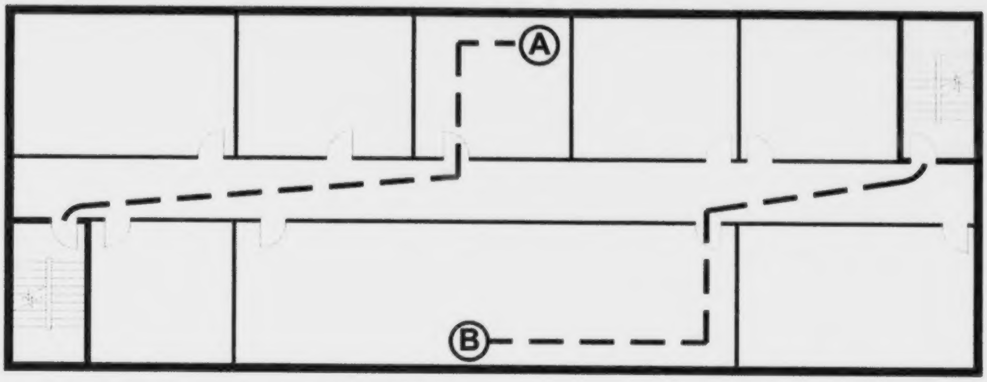
   a) business occupancy, unsprinklered
   b) residential occupancy, unsprinklered
   c) retail occupancy, sprinklered

3. Describe a condition under which the location of an exit is permitted to be sealed.

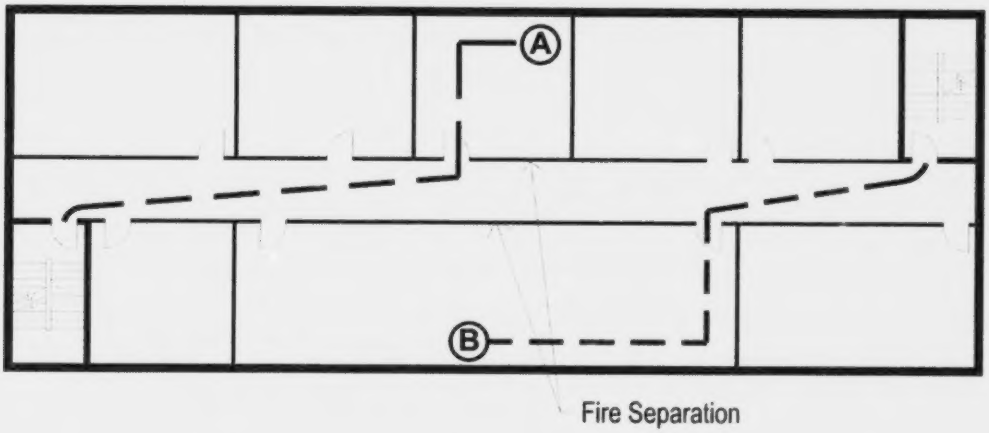
4. Using Figure 8-3, determine the maximum travel distances permitted from identified locations A and B to the nearest exit as shown on the drawing.

STOP

Maximum Travel Distances



3rd Storey Of Unsprinklered Office Building
A: Suite requiring 1 egress doorway
B: Suite requiring 2 egress doorway



3rd Storey Of Sprinklered Office Building
A: Suite requiring 1 egress doorway
B: Suite requiring 2 egress doorway

FIGURE 8-3

8.6 WIDTH AND HEIGHT OF EXITS

Width and height of exits are regulated in Subsection 3.4.3.

Take 15 minutes to read the following and complete Exercise #8-4.

An exit may consist of a corridor, passageway, stair, ramp or doorway. The primary factor used to determine the width of exits is the occupant load of the floor area. The minimum required width of exits is:

- the minimum prescribed by the building code, or
- the width necessary to accommodate the occupant load

Regardless of the occupant load, the minimum widths prescribed by Sentence 3.4.3.2.(7) are summarized in Table 8.2.

Exit width based on occupant load is calculated using exit capacity factors prescribed in Article 3.4.3.2. and are summarized in Table 8.3.

If more than one exit is required, every exit must be considered as contributing not more than 50% of the required exit width [3.4.3.2.(6)].

NOTES:

TABLE 8-2

Minimum widths as described in 3.4.3.2.(7) *

Type	Application	Minimum Width (mm)
Doorways	• serving patients' or residents' sleeping rooms	1050
	• not serving patients' or residents' sleeping rooms	790
Corridors & passageways	• all circumstances	1100
Stairs & ramps	• serving patients' and residents' sleeping rooms in Group B, Division 2 or 3 occupancy	1650
	• serving more than 2 storeys above grade or more than 1 storey below grade	1100
	• serving not more than 2 storeys above grade or not more than 1 storey below grade	900

TABLE 8-3

Minimum widths based on occupant load as described in 3.4.3.2.(1), (2) and (3)

Exit Component	Capacity factor (mm/person)
Doorway, passageway, corridor, ramp with slope not more than 1:8	6.1
Stair with steps whose rise is not more than 180 mm and whose run is not less than 280 mm (low slope)	8.0
Ramp with slope exceeding 1:8 Stair with steps whose rise exceeds 180 mm or whose run is less than 280 mm	9.2
Exits serving care or detection occupancies	18.4
Exit stairs serving open air assembly occupancies	2.4
Exit ramps and passageways, aisles, stairs other than exit stairs, serving open air assembly occupancies	1.8

* Other minimum widths may be required by other Parts of the Code

The required exit width for a known occupant load is determined by multiplying the occupant load by the appropriate factor.

EXAMPLE:

An occupant load of 175 persons requires a low-slope exit stair of 1400 mm width.

175 persons x 8.0 mm/person = 1400 mm [3.4.3.2.(1)(b)]

Conversely, determining the occupant load which may be served by an exit of known width is determined by dividing the exit width by the appropriate factor.

EXAMPLE:

A 915 mm doorway has an exit capacity of 150 persons.

915 mm/6.1 mm/person = 150 persons [3.4.3.2.(1)(a)]

Article 3.4.3.4. describes limited construction which may project or be fixed within the required width of an exit.

Table 8.4 summarizes requirements of Article 3.4.3.5. for minimum headroom in an exit:

TABLE 8-4

Location in Exit	Minimum Headroom (mm)
Doorway	2030
Door closer	1980
Stairways and landings	2050
Other locations	2100

EXERCISE #8-4

Read Subsection 3.4.3. and answer the following questions.

1. Refer to Figure 8-4. If the required width of the exit doorway is 790 mm, and 1100 mm for the stair, determine the minimum clear unobstructed width(s) for the following:

   a) Doorway A
   b) Landing at B
   c) Stair C

2. The second storey of a cinema complex contains 8 theatres with a total occupant load of 1,350 persons.

   a) If the floor area is served by 2 exits, calculate the minimum required width of the exit doorways to each exit stair.

   b) Refer to Figure 8-5. Exit doors in exits described above have a clear doorway opening of 850 mm. If the exit doors reduce the opening to 800 mm, determine how many doors are required for each exit.

   c) If the 2 exits contain stairs constructed with steps having 175 mm risers and 295 mm tread runs, calculate the minimum required width for each exit stair.

STOP

Widths and Heights of Exits

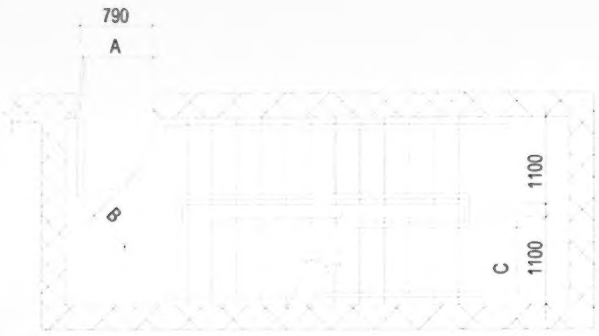

790
A
B
1100
C
1100

FIGURE 8-4

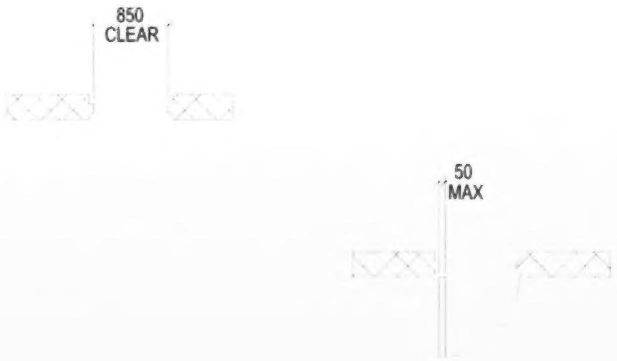

850
CLEAR
50
MAX

FIGURE 8-5

8.7 FIRE SEPARATION OF EXITS

Since travel distance is measured to the door that opens into an exit, it is imperative that exit stairwells and corridors protect occupants during their escape from the building.

To make this shield effective, the Code requires that exits be separated from the adjacent floor area by a fire separation. The walls of an exit shaft must have a fire-resistance rating not less than that required for the floor assemblies through which it passes, but not less than 45 minutes. As a result, large and high buildings will require exits to have greater fire-resistance ratings than small, low ones.

Fire separation requirements for exits are found in Subsection 3.4.4.

The basic requirement for ensuring that service penetrations do not adversely affect the integrity of a fire separation are regulated by Subsection 3.1.9. However, when it comes to the fire separations for exits, the Code is more restrictive. In addition to the requirements of Subsection 3.1.9., the limitations for service penetrations of exit fire separations and the integrity of exit facilities are provided in Article 3.4.4.4.

Code users will find that the Code requires exit facilities, such as stairwells, to empty directly to the exterior of the building, and provide continuous protection through the building during escape. There is one exception to this general rule. The Code permits one exit in a building to pass through a lobby if certain conditions are met. The level of safety is maintained by a number of requirements in Article 3.4.4.2. that are unique to lobbies used for this specific purpose.

Using Subsection 3.4.4., take 20 minutes to complete Exercise 8-5.

EXERCISE #8-5

1. Determine the fire-resistance rating required for an exit stair shaft in a storey where the floor assembly above the storey has the following fire-resistance rating:

Floor Assembly Fire-resistance Rating	Exit Fire-resistance Rating	OBC Reference
0 h (unrated fire separation)	*45 min*	*[3.4.4.1.(1)]*
1 h	*1 h*	*[3.4.4.1.(1)]*
2 h	*2 h*	*[3.4.4.1.(1)]*
3 h	*2 h*	*[3.4.4.1.(2)]*

2. The integrity of exit enclosures is important. List the openings that are permitted in a fire separation that separates an exit from the remainder of the building.

______________________________ [______________]

______________________________ [______________]

______________________________ [______________]

______________________________ [______________]

______________________________ [______________]

3. Service and ancillary rooms such as storage rooms, washrooms, toilet rooms, and laundry rooms cannot open directly into an exit. Imagine that there is no alternative: what must be located between such rooms and the exit?

______________________________ [______________]

4. Exiting from the second storey of a motel is provided by an exterior passageway. Describe conditions under which the exterior passageway will not be required to be separated with a fire separation from the remainder of the building.

______________________________ [______________]

______________________________ [______________]

5. Answer the following questions using the floor plan in Figure 8-6.

   a) What is the maximum length of travel (A) through the lobby?

   ______________________________ [______________]

   b) Identify uses of suite B that are not permitted to open into the exit lobby.

   ______________________________ [______________]

   ______________________________ [______________]

c) Is door C required as shown on the drawing, or can it be removed?

____________________[__________]

d) Is partition D required to be a fire separation?

____________________[__________]

e) What fire-resistance rating is required for partition D if:

i) the floor area is unsprinklered?

____________________[__________]

Equal to exit stair fire-resistance rating, [3.4.4.2.(2)(e)]

ii) the floor area is sprinklered?

____________________[__________]

6. Are passenger elevators permitted to open onto an exit lobby? If so, under what condition(s) is it permitted?

____________________[__________]

STOP

Fire Separation of Exits

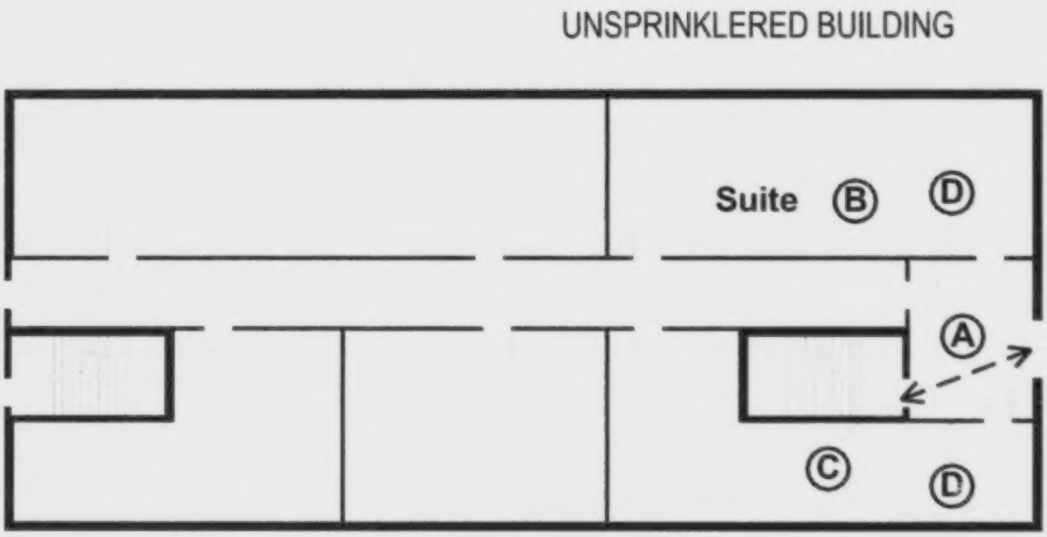

UNSPRINKLERED BUILDING
Suite
B
D
A
C
D

FIGURE 8-6

8.8 EXTERNAL PROTECTION OF EXITS

In addition to protection from direct fire exposure within the building, exits also require protection from fire exposure that may occur externally from openings in adjacent walls of the building served by the exit.

External fire protection of exits is addressed in Article 3.2.3.13. The requirements apply equally in both sprinklered and unsprinklered buildings.

EXERCISE #8-6

Take 15 minutes to read Article 3.2.3.12. and answer the following questions.

1. Openings requiring protection under this Article may be protected by one of the following:

   ____

   ____________________ [__________]

   ____

   ____________________ [__________]

   ____

   ____________________ [__________]

2. In accordance with Sentence 3.2.3.13.(1), openings in the exterior wall of an exit must be protected from openings in the wall of the building by protecting either the exit wall openings or the building wall openings if the walls are exposed at an angle of

   ____

   ____

   ____

3. Is it permitted to install a door with a fire protection rating in the exterior doorway from an exit stair shaft if the doorway is located within 3 m of an unprotected window in an adjacent floor area? Explain.

STOP

8.9 EXIT SIGNS

Exit signs are regulated in Subsection 3.4.5.

Exit signs are required to identify the location of exits to reduce the time occupants may spend seeking exit from a building. In smaller buildings having single entrance ways, it is assumed that the building occupants will be aware of the location of the door that leads to a place of safety. However, in larger and more complex buildings, the need arises to identify the exit path and doors that lead to places of safety.

EXERCISE #8-7

Take 10 minutes to read Subsection 3.4.5. and answer the following questions.

1. Which of the following exit sign colour schemes are permitted?

   a) Red letters on contrasting background

   ______________________________ [______________]

   b) Green background with contrasting letters

   ______________________________ [______________]

   c) Red background with contrasting letters

   ______________________________ [______________]

   d) Green letters with contrasting background

   ______________________________ [______________]

2. Identify requirements for letter size on exit signs.

   a) internally illuminated

   ______________________________ [______________]

   ______________________________ [______________]

      i) height

      ii) stroke

   b) externally illuminated

   ______________________________ [______________]

   ______________________________ [______________]

      i) height

      ii) stroke

3. Explain the purpose of exit signs required by Article 3.4.5.2.

   ____

   ____

   ____

STOP

8.10 TYPES OF EXITS

Subsection 3.4.6. describes the principal design requirements for exit stairs, ramps, guards, handrails, doors and hardware. The scope of Subsection 3.4.6. is summarized below:

3.4.6.1	Slip resistance of ramps and stairs
3.4.6.2	Minimum number of risers
3.4.6.3	Landings and maximum vertical rise of stair flights
3.4.6.4	Handrails
3.4.6.5	Guards
3.4.6.6	Ramp slope
3.4.6.7	Treads and risers
3.4.6.8	Curved stairs
3.4.6.9	Horizontal exits
3.4.6.10	Doors
3.4.6.11	Direction of door swing
3.4.6.12	Self-closing devices
3.4.6.13	Sliding doors
3.4.6.14	Revolving doors
3.4.6.15	Door release hardware
3.4.6.16	Reserved
3.4.6.17	Emergency access to floor areas
3.4.6.18	Floor numbering

EXERCISE #8-8

Take 20 minutes to read Articles 3.4.6.1. to 3.4.6.7. and Article 3.4.6.10. and answer the following questions.

1. Figure 8-7 illustrates an exit stair with a required width of 1200 mm based on occupant load. Complete the dimensions in the following table:

Drawing Reference	Subject	Code Reference	Code Requirement
A	Landing width	3.4.6.3.(2)	1200 mm
B	Handrail extension at top	3.4.6.4.(7)	300 mm
C	Handrail extension at bottom	3.4.6.4.(7)	300 mm plus tread depth
D	Clearance of stair riser to leading edge of door	3.4.6.10.(1)	300 mm
E	Height of riser	3.4.6.7.(2)	200 mm max. 125 mm min.
F	Run	3.4.6.7.(1)	255 mm min. 355 mm max.
G	Maximum vertical rise of stair flight	3.4.6.3.(1)	3.7 m max. except for Group B, Division 2 or 3

Exit Stair

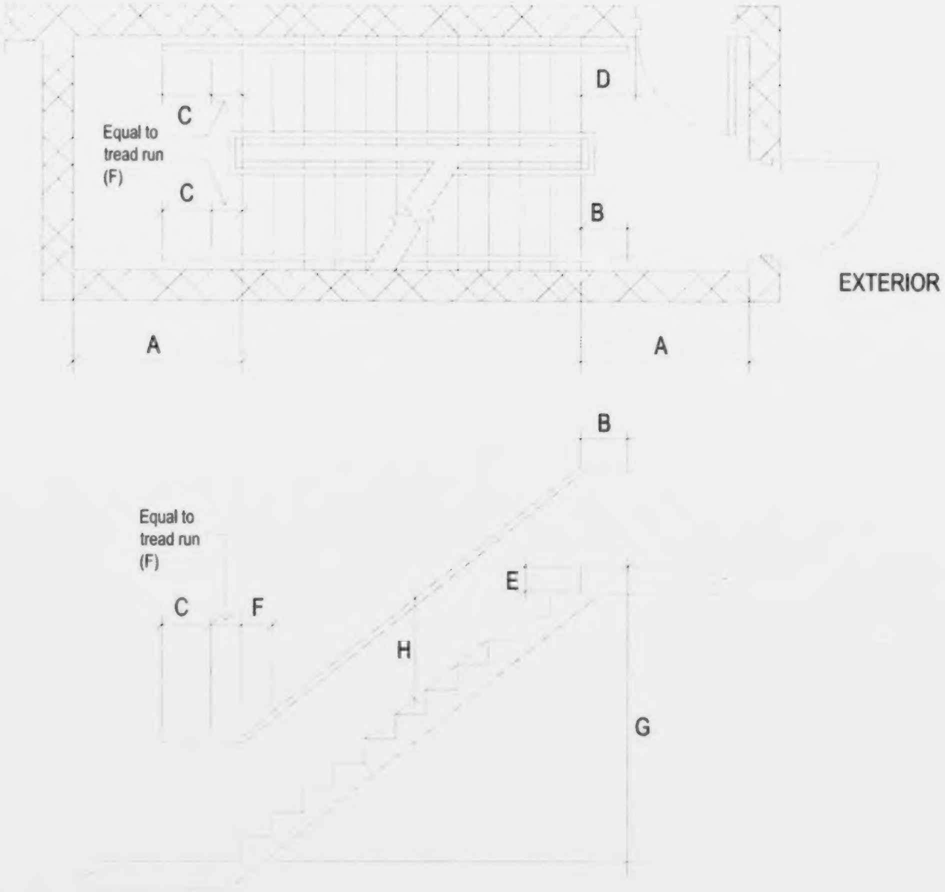

D
C
Equal to tread run (F)
C
B
EXTERIOR
A
A
B
Equal to tread run (F)
C
F
E
H
G

FIGURE 8-7

2. Except for food and beverage establishments, Article 3.4.6.2. requires interior stairs to have at least 3 risers. Article 3.4.6.7. requires each riser to have a minimum 125 mm height. Suggest a design solution to accommodate a change in exit floor elevation of only 250 mm.

______________________ [____________]

3. Complete the following table to summarize the maximum slope of ramps used as exits.

Major Occupancy or Application	Maximum Slope *	Code Reference
Assembly Care or detention Residential	1:10	3.4.6.6.(1)(a)
Mercantile Industrial	1:6	3.4.6.6.(1)(b)
Other	1:8	3.4.6.6.(1)(c)
Exterior	1:10	3.4.6.6.(1)(d)

* Note: In a barrier-free path of travel, ramp slope is limited to 1:12 [3.8.3.4.]

4. Select the correct maximum slope for an exterior ramp at exit doors from a retail mall.

a) 1:6
b) 1:8
c) 1:10
d) 1:12

______________________ [____________]

STOP

Door Swing

A door serving an exit facility is normally required to swing on a vertical axis in the direction of travel to the exit. This ensures that the door will not be blocked from opening if a person collapses against it. This could prevent the evacuation of other persons in the same space and could prevent firefighters gaining easy access to the space to undertake firefighting operations.

EXERCISE #8-9

Take 15 minutes to read Articles 3.4.6.10. to 3.4.6.12. and Sentences 3.4.6.15.(1) and (2), and complete the following questions.

1. Identify the condition where an exit door, swinging on its vertical axis, is permitted to open in a direction opposite to the direction of exit travel.

Yes No

a) Serving a single dwelling unit [3.4.6.11.(2)]

______________________[______________]

b) Where the door may be in danger of blockage from ice or snow [3.4.6.10.(2)]

______________________[______________]

c) Serving a room, suite or floor area having an occupant load not greater than 60 persons (excluding F-1major occupancies) [3.4.6.11.(3)(a)]

______________________[______________]

d) Serving multiple floor areas having a total occupant load not greater than 60 persons (excluding F-1 major occupancies) [3.4.6.11.(3)(b)]

______________________[______________]

2. Identify which of the following exit doors require release hardware operated with the application of a 90 N force to the hardware in the direction of exit travel.

a) exit door serving a floor area of high hazard industrial major occupancy with an occupant load of 40 persons

____________________________[______________]

b) exit door serving a restaurant with an occupant load of 130 persons

______________________________ [______________]

c) exit door to the exterior from an exit stair serving a 4 storey apartment building with an occupant load of 92 persons

______________________________ [______________]

3. It was previously noted in Clause 3.4.3.2.(7)(g) that the minimum width of an exit door is 790 mm. However, Sentence 3.4.6.10.(4) permits a minimum door leaf width of 600 mm provided:

____

______________________________ [______________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 9

LARGE BUILDINGS - 2006

VERTICAL TRANSPORTATION

SERVICE FACILITIES

ANCHORAGE FOR FIXED ACCESS LADDERS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

9.1 INTRODUCTION

Vertical transportation refers to elevators, escalators and dumb waiters (Section 3.5).

Service facilities refers to horizontal service spaces, vertical service spaces, attic or roof spaces, ducts, crawl spaces, shaft spaces, service rooms and mechanical penthouses, and facilities contained therein (Section 3.6).

In general, service facilities are divided into two general categories of (1) equipment and (2) the interconnecting piping and wiring. Service equipment, such as furnaces, are normally located in service rooms, whereas the distribution and recirculating duct work would normally be located in service spaces.

Design, construction and installation of anchorage system for fixed access ladders refers to the design and construction of a fixed access ladder providing access to the roof of a building (Supplementary Standard SB-8).

This module will concentrate on requirements in the Building Code for the design and construction of vertical transportation, service facilities, and the design, construction and installation of anchorage system for fixed access ladders.

This module will include a list of defined terms relating to the content in this module. For a complete list of definitions, refer to the Code.

Objectives

- To provide a basic understanding of the code intent and application of vertical transportation, service facilities, and the design, construction and installation of anchorage system for fixed access ladder requirements in the Code.

- To demonstrate comprehension of applicable Code requirements through the use of exercises.
- To identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.
- Students will learn where the relevant sections are located in the Code to gain a better understanding of fire separations for service rooms and service spaces, elevator car dimensions and signs, requirements for service rooms, vertical and horizontal service spaces, as well as the design, constructions and installation of anchorage system for fixed access ladder.
- Reference applicable standards.

Upon completion of this module, you will be able to:

- Determine the required minimum fire-resistance ratings for elevator hoistways, dumbwaiters, elevator machine rooms, service rooms, and vertical and horizontal service spaces.
- Review the design and installation of anchorage system for fixed access ladders.

STOP

9.2 OVERVIEW

Read to next STOP sign.

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. Defined terms will not be shown in italics in this module, other than in this section.

Appliance
Appliance means a device to convert fuel into energy and includes all components, controls, wiring and piping required to be part of the device by the applicable standard referred to in this Code.

Fire-resistance rating
Fire-resistance rating means the time in minutes or hours that a material or assembly of materials will withstand the passage of flame and the transmission of heat when exposed to fire under specified conditions of test and performance criteria or as determined by extension or interpretation of information derived from that test and performance as prescribed in this Code.

Fire separation
Fire separation means a construction assembly that acts as a barrier against the spread of fire.

Fire stop flap
Fire stop flap means a device intended for use in horizontal assemblies required to have a fire-resistance rating and incorporating protective ceiling membranes, which operates to close off a duct opening through the membrane in the event of a fire.

Horizontal service space

Horizontal service space means a space such as an attic, duct, ceiling, roof or crawl space oriented essentially in the horizontal plane, concealed and generally inaccessible, through which building service facilities such as pipes, ducts and wiring may pass.

Plenum

Plenum means a chamber forming part of an air duct system.

Service room

Service room means a room provided in a building to contain equipment associated with building services.

Service space

Service space means space provided in a building to facilitate or conceal the installation of building service facilities such as chutes, ducts, pipes, shafts and wires.

Vertical service space

Vertical service space means a shaft oriented essentially vertically that is provided in a building to facilitate the installation of building services including mechanical, electrical and plumbing installations and facilities such as elevator, refuse chutes and linen chutes.

STOP

9.3 VERTICAL TRANSPORTATION (Section 3.5)

Firefighter's elevators large enough to accommodate a stretcher in a horizontal position are required in high buildings and in a Group B, Division 2 or 3 occupancy. If sleeping rooms are provided on more than one floor, and if the floor levels are not connected by ramps [3.5.2.1.(1)].

The Code requires elevator hoistways to be separated by a fire separation having a fire-resistance rating from the remainder of the storey it serves and from storeys through which it passes. Similarly, the elevator machine room is required to be separated by a fire separation having a fire-resistance rating from all other parts of the building. However, the Code recognizes that an elevator machine room cannot be easily separated from the elevator hoistway it serves, and omits the required fire separation at this location (see Figure 9-1).

It is also important to note that in addition to moving people between floor levels, elevators are also used by firefighters and emergency personnel who may be required to use the elevator to evacuate various persons.

STOP

Article 3.5.3.3.

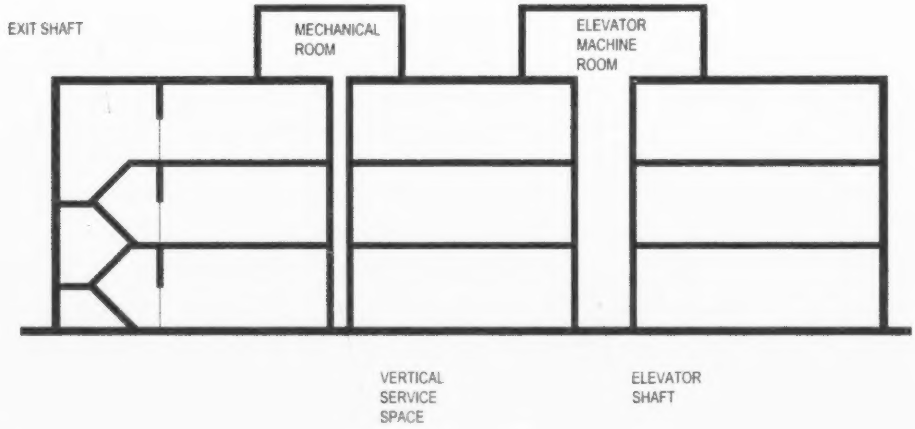

EXIT SHAFT
MECHANICAL ROOM
ELEVATOR MACHINE ROOM
VERTICAL SERVICE SPACE
ELEVATOR SHAFT

FIGURE 9-1

EXERCISE #9-1

Take 10 minutes to read Subsections 3.5.3., 3.5.4., and 3.6.3. Answer the following questions and provide Code references with answers where applicable.

Discuss answers with your group to obtain a consensus.

1. What is the minimum fire-resistance rating for a vertical service space used as an elevator hoistway in a building where the floor assemblies are required to be fire separations having a 1 h fire-resistance rating?

   ______________________ [______________]

2. Except for the elevator hoistway, elevator machine rooms are required to be separated from all other parts of the building with the exception of the hoistway by a fire separation having a fire-resistance rating not less than that required of the vertical service space containing the elevator hoistway. True or false?

   ______________________ [______________]

2. An elevator car used to conform to the requirements of Article 3.3.1.7. must be large enough to accommodate what size of stretcher?

   ____

   ______________________ [______________]

STOP

9.4 FIRE SEPARATIONS AROUND SERVICE ROOMS (Subsection 3.6.2.)

Generally, a room housing a fuel-fired appliance is required to be separated from the remainder of the building by a fire separation having a fire-resistance rating as specified in the 3.6.2.1.(1) and (2), depending on major occupancy.

However, the Code provides exceptions to the general requirements of providing a fire separation for service facilities. For example, a fire separation is not required between a fireplace and the space it serves [3.6.2.1.(9)], or between a rooftop appliance and the building it serves [3.6.2.1.(10)]. Nor is a fire separation required for a fuel-fired appliance if the appliance serves not more than one room or suite in a building [3.6.2.1.(2)]. If a room contains a limited quantity of service equipment and the equipment does not constitute a fire hazard, a fire separation required by Sentence 3.6.2.1.(5) is not required [3.6.2.2.].

Service rooms containing service equipment subject to possible explosion, such as boilers, transformers and refrigeration plants, must not be located directly under a required exit [3.6.2.2.(1)].

A service room that contains an incinerator shall not contain other fuel-fired appliances [3.6.2.4.(1)].

Combustible refuse storage rooms shall be separated from the remainder of the building by a fire separation with a 1 h fire-resistance rating and be sprinklered [3.6.2.5.(1)].

The room in which a refuse chute discharges must be separated from the remainder of the building by a 2 h fire resistance rating [3.6.3.3.(9)].

Boiler or incinerator room doors shall swing inward if the door opens into a corridor or any room used for assembly occupancy [3.6.2.6.(1)].

Electrical equipment vaults are required primarily for electrical equipment that contains flammable or combustible liquids, and are required to be enclosed by a fire separation of solid masonry or concrete, having a 3 h fire-resistance rating, or a 2 h fire-resistance rating if equipped with an automatic extinguishing system [3.6.2.7.(1)].

If the building is sprinklered, the electrical equipment vault is not required to be sprinklered if:

- the vault is designed for no other than to contain electrical equipment, and
- a smoke detector is provided in the vault [3.6.2.7.(3)].

STOP

EXERCISE #9-2

Take 10 minutes to read Subsection 3.6.2. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the minimum required fire-resistance rating for a room containing a fuel-fired appliance that serves more than one suite in a three storey building of Group A occupancy?

   ______________________________ [______________]

3. Is a boiler operating in excess of 100 kPa permitted in a room located under an exit?

   ______________________________ [______________]

3. What is the required fire-resistance rating of a sprinklered combustible refuse storage room in which a refuse chute does not discharge?

   ______________________________ [______________]

STOP

9.5 VERTICAL SERVICE SPACES (Subsection 3.6.3.)

Vertical service spaces and Service facilities are regulated by Articles 3.6.3.1. to 3.6.3.4.

Vertical service spaces are shafts that contain building services such as heating and ventilating ducts, plumbing pipes, electrical cables, linen and refuse chutes. A vertical service space does not include exits. Exit facilities are covered separately in Section 3.4. Although elevator hoistways are a type of vertical service space, they are covered separately in Section 3.5.

Vertical service spaces or shafts, are required to be protected from the effects of a fire in an adjacent storey, based on the expected fire load in the floor area. Similarly, the floor areas are required to be protected from a fire in the shaft, which could expose a number of storeys simultaneously.

Vertical service spaces are required to be separated from all other portions of each adjacent storey by a fire separation. Vertical service spaces that do not extend through the roof shall be enclosed at the top of the space by a fire-resistance rating not less than that required for the shaft walls [3.6.3.1.(1) and (2)].

Vertical service spaces that do not extend to the bottom of the building shall be enclosed at the bottom of the space by a fire-resistance rating of not less than that required for the shaft walls [3.6.3.1.(3)].

Vents in the shaft shall extend to the roof or be enclosed by a fire-resistance rating not less than that required for the shaft [3.6.3.1.(4)].

Openings used for no other purpose, than to serve the shaft are permitted through the service space enclosure [3.6.3.1.(5)].

Linen and refuse chutes shall be impervious to moisture, have a smooth internal surface, be corrosion-resistant, be constructed of noncombustible material, and be in a shaft with no other services [3.6.3.3.(1)].

Interior linen or refuse chutes shall extend not less than 1 metre above the roof and shall be vented above the roof in addition to other requirements listed in Sentence 3.6.3.3.(3).

STOP

EXERCISE #9-3

Take a few minutes to review Subsection 3.6.3. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. List five required properties of a linen chute.

____

____

____

____

________________________ [______________]

2. How would you terminate a vertical service space that does not extend through the roof of a building?

____

________________________ [______________]

3. What is the required fire-resistance rating for the fire separation of a vertical service space in a building required to have 2 h floor assemblies?

____

________________________ [______________]

STOP

9.6 HORIZONTAL SERVICE SPACES AND SERVICE FACILITIES (Subsection 3.6.4.)

Horizontal service spaces and service facilities are regulated in Articles 3.6.4.1. to 3.6.4.6.

Crawl spaces, spaces within floor and ceiling assemblies, and spaces within roof systems are examples of horizontal service spaces [3.6.4.1.(1)]. The Code places limits on their size in order to control the potential spread of fire. Horizontal service spaces need to be separated from the space below if they penetrate a vertical fire separation [3.6.4.2.(1)]. For example, when a fire separation wall terminates at the underside of a ceiling, in order to avoid the difficulties of installing services that pass above the wall within the ceiling space, the ceiling forming part of the horizontal service space is required to be a fire separation [3.6.4.2.(2)].

A horizontal service space that penetrates a required vertical fire separation shall be separated from the remainder of the building it serves [3.6.4.2.].

In general materials in a plenum within a floor or roof assembly are required to have a flame-spread rating not more than 25 and a smoke developed classification not more than 50 (note the exceptions stated in Article 3.6.4.3.(1)(a)).

If a return air plenum incorporates a ceiling membrane that forms part of a required fire-resistance rating of the assembly, every opening in the membrane shall be protected by a fire stop flap [3.6.4.3.(2)].

STOP

EXERCISE #9-4

Take 10 minutes to read Subsection 3.6.4. and answer the following questions. Provide references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the maximum flame-spread rating and smoke developed classification for materials in a plenum in a floor assembly?

   ______________________________[______________]

2. What is the minimum size of access opening required for a crawl space?

   ______________________________[______________]

3. In a ceiling plenum that incorporates a firestop flap, which test must the flap conform to?

   ____

   ______________________________[______________]

STOP

9.7 DESIGN, CONSTRUCTION AND INSTALLATION OF ANCHORAGE SYSTEMS FOR FIXED LADDERS (SB-8)

Fixed ladders that are installed to provide access to a roof of a building are required by Sentence 3.6.1.5(1) to have their attachment and anchorage systems designed and installed in accordance with the Supplementary Standard SB-8.

The minimum design live load should be two loads of 1.1 KN each concentrated between any two consecutive attachments.

Ice, wind, rigging, impact and dead loads must be considered in the design, and a safety factor of 4:1 should be applied for normal usage and a safety factor of 10:1 for fall arrest systems.

Expansion anchors should be avoided in masonry walls. Through-bolted connections or equivalent must be used in masonry walls. Attachment anchor bolts should be a minimum of 12 mm in diameter.

The maximum spacing of attachments for a steel ladder is 3 metres.

To provide an improved margin of safety, there should be two means of anchorage at the top of the ladders. If a ladder has to be attached to an existing wall, the structural soundness of the walls should be investigated.

EXERCISE #9-5

Take 10 minutes to read Supplementary Standard SB-8 and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the minimum design live load between two consecutive attachments in a fixed ladder?

   ______________________ [________________]

2. What type of anchor should be avoided when fastening a ladder onto a masonry wall?

   ______________________ [________________]

3. What should be done to provide an improved margin of safety for fixed access ladders?

   ______________________ [________________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 10

LARGE BUILDINGS - 2006

HEALTH REQUIREMENTS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

10.1 INTRODUCTION

Health requirements refers to prescriptive requirements for the height and area of rooms, window areas, protection of windows in apartment buildings, ventilation, plumbing facilities, health care facility systems and food premises.

This module will examine the requirements of Section 3.7.

This module will include a list of defined terms relating to the content in this module. For a complete list of definitions, refer to the Code.

Objectives

- To provide a general understanding of the code intent and application of health requirements in the Code.
- Understand the factors that contribute to the design of windows, ventilation, plumbing facilities, health care facility systems and food premises.
- To demonstrate comprehension of applicable Code requirements through the use of exercises.
- To identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.
- Students will learn where the relevant sections are located in the Code to gain a better understanding of height and area of rooms, windows, ventilation, plumbing facilities, health care facility systems and food premises.
- Reference applicable standards.

Upon completion of this module, you will be able to:

- Calculate required minimum height and area of rooms,
- Determine the minimum size of window areas,
- Calculate the number of washroom facilities,
- Determine the location of plumbing facilities, and
- List room finishes in food premises and systems in health care facilities.

STOP

10.2 OVERVIEW

Read to next STOP sign.

Definitions

The definitions below relate to the content in this module and are taken from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. Defined terms will not be shown in italics in this module, other than in these definitions.

Design load
Design load means the load applied to a foundation unit which is not greater than the allowable load.

Dwelling unit
Dwelling unit means a suite operated in a housekeeping unit, used or intended to be used as a domicile by one or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Fixture
Fixture means a receptacle, plumbing appliance, apparatus or other device that discharges sewage or clear water waste, and includes a floor drain.

Food premise
Food premise means a floor area where food or drink for human consumption, or an ingredient of food or drink for human consumption, is manufactured, processed, prepared, stored, displayed, handled, served, distributed, sold, or offered for sale, but does not include:

a) a private residence,
b) a boarding house that provides meals for fewer than ten boarders,
c) a building to which Regulation 554 or 568 of the Revised Regulations of Ontario, 1990 applies,

d) a plant defined in the Milk Act, that is required to be operated under the authority of a licence issued under that Act,
e) premises where a licenced activity, as defined in the "Food Safety and Quality Act" 2001, is carried out by a person who is required to hold a licence issued under that Act,
f) an egg-grading station or a processed egg station that is required to be operated under the authority of a licence issued under the Livestock and Livestock Productions Act,
g) a floor area occupied by a church, service club or fraternal organization for the purpose of
   (i) preparing meals for special events for its members and personally invited guests, or
   (ii) conducting bake sales,
h) a farm building.

Guard

Guard means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such barrier may or may not have openings through it.

Live/work unit

Live/work unit means a dwelling unit that contains a subsidiary business and personal services occupancy, or a subsidiary low hazard industrial occupancy, that has an area of not more than 150 m^2, and is used and operated by one or more persons of a single household.

Occupancy

Occupancy means the use or intended use of a building or part thereof for the shelter or support of persons, animals or property.

Plumbing appliance

Plumbing appliance means a receptacle or equipment that receives or collects water, liquids or sewage and discharges water, liquids or sewage directly or indirectly to a plumbing system.

Plumbing system

Plumbing system means a system of connected piping, fittings, valves, equipment, fixtures and appurtenances contained in plumbing.

Potable water

Potable water means fit for human consumption.

Recreational camp

Recreational camp means a camp for recreational activities consisting of one or more buildings or other structures, established or maintained as living quarters with or without charge for 10 or more persons, for temporary occupancy for five or more days.

Sanitary drainage system

Sanitary drainage system means a drainage system that conducts sanitary sewage.

X-ray equipment

X-ray equipment includes x-ray imaging systems, processing equipment and equipment directly related to the production of images for diagnosis or directly related to irradiation with x-rays for therapy.

STOP

10.3 HEIGHT AND AREA OF ROOMS (Subsection 3.7.1.)

The health requirements contained in Part 3 are provided to address those aspects of a building that could result in sickness or discomfort for the occupants, but does not include those safety matters that are under the jurisdiction of other authorities (i.e. Occupational Health and Safety Act).

The ceiling fixtures and ceiling height shall not create an obstruction for occupants [3.7.1.1.(1)].

The height of Group C occupancies in dwelling units and sleeping rooms shall conform to Subsection 9.5.3. "Ceiling Heights" [3.7.1.1.(2)].

STOP

EXERCISE #10-1

Take a few minutes to read Subsection 3.7.1. and 9.5.7. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the minimum size of a second bedroom in a dwelling unit that does not have built-in cabinets?

   ______________________________[________________]

2. In a recreational camp what is the minimum area per person (camper) of a single sleeping quarters without single beds?

   ______________________________[________________]

STOP

10.4 WINDOWS (Subsection 3.7.2.)

To ensure adequate light, the Code requires that windows be provided in rooms and spaces. Additionally, windows may also provide natural ventilation and access to the dwelling unit from the exterior for firefighters if the window is within reach of ladders. Part 9 of the Code specifies the requirements for windows in dwelling units.

Nursing homes shall have window(s) with an unobstructed glass area of not less than 10% of the area of the activity rooms, sitting rooms, or lounges [3.7.2.1.(2)(a)].

Resident sleeping rooms shall have one or more windows that have a total unobstructed glass area of not less than 10 % of the area of the room, if they open to the outdoors, have a total unobstructed glass area of 5% of the area of the room, and be installed with the bottom edge not more than 660 mm above the floor [3.7.2.1.(2)(b)].

Windows in apartment buildings shall be protected to minimize the hazard of children. Fixed windows within dwelling units that extend to less than 1000 mm from the floor shall be protected by guards to at least 1000 mm above the floor, or shall be designed to withstand lateral design loads for balcony guards [3.7.2.2.].

STOP

EXERCISE#10-2

Take 10 minutes to read Subsection 3.7.2. and Section 9.7 and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the minimum window size for a kitchen in a residential dwelling with electric lighting?

   ______________________________[________________]

2. What is the minimum height of a guard for a fixed window in a dwelling unit that is less than 1000 mm above the floor, if there is no balcony and the dwelling unit is located in an apartment building?

   ______________________________[________________]

3. What is necessary to protect a window in a dwelling unit that opens 2100 mm above grade and less than 1500 mm above the floor?

   ____

   ______________________________[________________]

4. What Standard regulates the requirements for a heavy duty screen in the operable portion of a controlled sash?

   ______________________________[________________]

STOP

10.5 VENTILATION

All rooms and spaces shall be ventilated to conform to Part 6 of the Code.

Ventilation systems frequently interact with systems that control the spread of fire and smoke. Fire dampers are commonly installed in ducts that pass through fire separations. High buildings require special smoke control measures to help maintain the tenability of occupied floor spaces during a fire emergency.

Part 6 makes some references to Part 3 requirements. For example, ducts in Article 6.2.3.2. must conform to Subsection 3.1.9. (firestopping when a fire separation is penetrated).

Notes:

STOP

10.6 PLUMBING FACILITIES (Subsection 3.7.4.)

Plumbing facilities are regulated under Article 3.7.4.1 to 3.7.4.18.

Each building situated on property that abuts a street in which a public or municipal water main is located shall be provided with a plumbing system including potable water supply, sanitary drainage system, and plumbing fixtures. When the installation of a sanitary drainage system is not possible because of the absence of water supply, sanitary privies, chemical closets or other means for the disposal of human waste shall be provided [3.7.4.1.].

The following is an example of the steps that may be used to determine the amount of water closets and lavatories required in a typical building.

1. Calculate occupant load in accordance with Subsection 3.1.17.

2. Use the applicable article in Subsection 3.7.4. to determine the required number of water closets for each sex.

3. Calculate number of lavatories from Article 3.7.4.2 (5).

4. Water closets shall be provided for each sex assuming that the occupant load is equally divided between males and females [3.7.4.2.(2)]

   However, both sexes are permitted to be served by a single water closet if the occupant load is not more than 10 persons in assembly occupancy except for:

   - Elementary and secondary schools,
   - Child care facilities,
   - Place of worship,
   - Undertaking premises,
   - Dining rooms, restaurants, cafeterias and alcoholic beverage establishments [3.7.4.2.(8)].

5. The water closet and lavatory provided in a universal toilet room may be counted as part of the plumbing fixtures required for males and females if:

   - More than one water closet is required for males, and
   - More than one water closet is required for females [3.7.4.2.(7)].

6. Lavatories, except for dwelling units, are required to be equipped with faucets that operate automatically, or have lever type handles that do not close under spring action [3.7.4.2.(10)].

STOP

EXERCISE #10-3

Take 10 minutes to read Subsection 3.7.4. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. Calculate the minimum number of water closets required for a 1000 m^2 Group D occupancy office building.

   ______________________ [______________]

   ______________________ [______________]

2. Calculate the minimum number of lavatories required for a washroom required to have five water closets.

   ____

   ______________________ [______________]

3. If five water closets are required in a male washroom of an office building, how many of these water closets are permitted to be urinals?

   ____

   ______________________ [______________]

4. How many male and female water closets are required for an elementary school of 500 persons?

   ____

   ____

   ______________________ [______________]

STOP

10.7 HEALTH CARE FACILITY SYSTEMS (Subsection 3.7.5.)

Health care facility systems are regulated by Subsection 3.7.5.

In anaesthetizing locations, electrical systems shall be designed, constructed, installed and tested in conformance with CSA Z32, "Essential Electrical Systems in Health Care Facilities", 2000 edition [3.7.5.1.(1)].

All medical gas piping systems shall be designed, constructed, installed and tested in conformance with CSA Z305.1-92 [3.7.5.2.(1)].

Every installation of an x-ray machine or x-ray equipment in a building shall be shielded to protect any person who could be exposed to radiation inside or outside the building [3.7.5.3.(1)].

Take 5 minutes to read Subsection 3.7.5.

Notes:

STOP

10.8 FOOD PREMISES
(Subsection 3.7.6.)

Food premises are regulated under Subsection 3.7.6.

EXERCISE #10-4

Take 5 minutes to read Subsection 3.7.6. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain consensus.

1. In a cafeteria, what type of floor covering is required in the food preparation area?

   ______________________________ [______________]

2. Under what condition is a washroom for a restaurant permitted to be located outside the restaurant?

   ____

   ______________________________ [______________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

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MODULE 11

LARGE BUILDINGS - 2006

BARRIER-FREE DESIGN

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

11.1 INTRODUCTION (Section 3.8)

Barrier-free, as defined in the Building Code, means *that a building and its facilities can be approached, entered, and used by persons with physical or sensory disabilities*.

Section 3.8 applies to the majority of new buildings, and to extensions or material alterations to existing buildings, and excludes only smaller residential buildings (i.e. generally as defined in Part 9), Group F, Division 1 major occupancies, and those buildings which are not intended to be occupied on a daily or full-time basis. The Code specifies how to make buildings and other facilities barrier-free, accessible and safely usable by persons with physical or sensory disabilities. The Code considers the following disabilities:

- mobility impairment (i.e. crutches, wheelchair)
- reaching and manipulation disabilities
- hearing impairment
- visual impairment.

It may be beneficial to note that a concept of the Human Rights Legislation is not to discriminate against disabled persons in specific building occupancies, whether they be tenants, visitors or employees.

This module will focus on the occupancy requirements and design standards for barrier-free design. The majority of these requirements are found in Section 3.8.

Objectives

- To provide an understanding of the Code intent and application of barrier-free design requirements in the Code.

- To assist with comprehension of applicable Code requirements through the use of exercises.

- To identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.

- Students will learn where the relevant sections are located in the Code to analyze a building and to what extent barrier-free design is applicable.

Upon completion of this module, you will be able to:

- determine to what extent barrier-free design is applicable to each occupancy and ancillary space.

- understand the design standards applicable to different components that form part of a barrier-free path of travel.

11.2 OVERVIEW

Definitions

The following definitions are taken from Division A, Part 1. While italicized in this section, they will not be italicized in the remainder of this module.

Dwelling unit
Dwelling unit means a suite operated as a housekeeping unit, used or intended to be used as a domicile by 1 or more persons and usually containing cooking, eating, living, sleeping and sanitary facilities.

Guard
Guard means a protective barrier, with or without openings through it, that is around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another.

Occupancy
Occupancy means the use or intended use of a building or part of a building for the shelter or support of persons, animals or property.

Occupant load
Occupant load means the number of persons for which a building or part of a building is designed.

Storey
Storey means that portion of a building which is situated between the top of any floor and the top of the floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

Suite

Suite means a single room or series of rooms of complementary use, operated under a single tenancy, and includes dwelling units, individual guest rooms in motels, hotels, boarding houses, rooming houses and dormitories as well as individual stores and individual or complementary rooms for business and personal services occupancies.

General Overview

Except where essential obstructions in the work area would make a barrier-free path of travel hazardous, a barrier-free path or travel from the entrances required to be barrier-free shall be provided throughout the entrance storey and within all normally occupied floor areas served by a passenger type elevator or other platform equipped passenger elevating device.

A barrier-free path of travel is generally an accessible route from the sidewalk or roadway and parking area to a principal building entrance and its ground floor level. Where elevating devices are provided within the building to other storeys, it is intended that a barrier-free path of travel be provided to those accessible floor levels [3.8.1.2.].

It is not intended that a person requiring assistance be required to travel outside the building in order to gain access to another level.

STOP

11.3 GENERAL REQUIREMENTS

With few exceptions, barrier-free design applies to all buildings.

EXERCISE #11-1

Take 15 minutes to read Subsection 3.8.1. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. Which of the following types of buildings will require barrier-free design?
   a) high hazard industrial occupancies
   b) boarding and rooming houses serving 8 people or more
   c) buildings occupied on a part-time basis such as pump houses and substations
   d) houses, including townhouses and row houses

   ________________________________ [________________]

2. What is the total number of pedestrian entrances required to be barrier-free in a building that contains a total of (5) five entrances, where (4) four of the entrances serve mercantile occupancies, and (1) one entrance serves an assembly occupancy which is completely separated from the remainder of the building (i.e. assembly occupancy is not accessible via entrances serving mercantile occupancies)? Refer to Figure 11-1.

   ____

   ____

   ____

   ________________________________ [________________]

3. If at a required barrier-free entrance there are six exterior doors, all doors are required to be designed in accordance with Section 3.8. True or false?

____

____

____________________________ [______________]

4. A barrier-free path of travel is provided with the minimum width permitted under Sentence 3.8.1.3.(1) and has a length of 31 m. What provisions are required for a wheelchair?

____

____

____________________________ [______________]

5. Summarize the general requirements for a barrier-free path of travel with respect to walking surfaces, building controls and illumination. With respect to illumination, identify the Code reference that outlines the specific requirements.

____

____

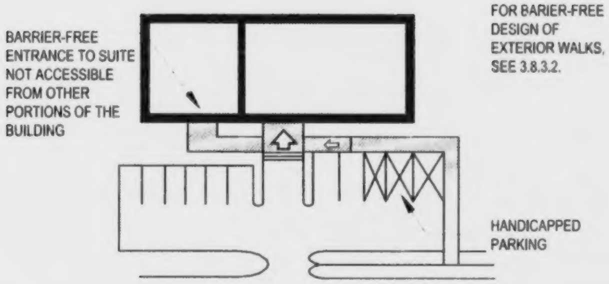
____

____

____

____________________________ [______________]

STOP


BARRIER-FREE
ENTRANCE TO SUITE
NOT ACCESSIBLE
FROM OTHER
PORTIONS OF THE
BUILDING
FOR BARIER-FREE
DESIGN OF
EXTERIOR WALKS,
SEE 3.8.3.2.
HANDICAPPED
PARKING

Suites of assembly occupancy, office or retail use on the first storey or other barrier-free accessible floor levels, and which are not accessible from the remainder of the building, require individual barrier-free entrances.

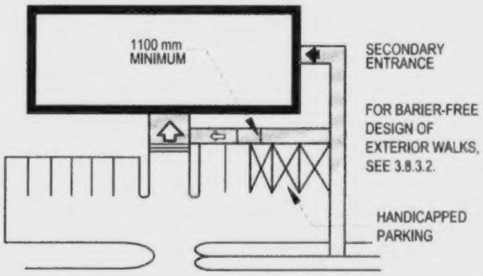

1100 mm
MINIMUM
SECONDARY
ENTRANCE
FOR BARIER-FREE
DESIGN OF
EXTERIOR WALKS,
SEE 3.8.3.2.
HANDICAPPED
PARKING

FIGURE 11-1

11.4 OCCUPANCY REQUIREMENTS

Generally a barrier-free path of travel is required throughout the entrance storey, and within every floor area served by an elevator or other passenger elevator device in all buildings, except to those occupancies which are exempt from accessibility requirements.

Occupancies that are exempt from accessibility requirements are as follows:

a) houses, including semi-detached houses, duplexes, triplexes, townhouses, row houses and boarding or rooming houses with fewer than 8 boarders or roomers,

b) Group F, Division 1 major occupancies, and

c) buildings which are not intended to be occupied on a daily or full time basis, including automatic telephone exchanges, pumphouses and substations [3.8.1.1.(1)].

EXERCISE #11-2

Take 25 minutes to read Subsection 3.8.2. and answer the following questions.

1. The provision of a barrier-free path of travel for residential occupancies applies to which of the following:

   a) into suites that are located in storeys above the entrance storey and not served by an elevator
   b) into suites served by an elevator
   c) within all portions of suites served by an elevator
   d) egress from suites served by an elevator

   ____

   ____

   ____________________ [__________]

2. When is a balcony in a dwelling suite required to be barrier-free accessible? (Hint: Review requirements of Article 3.3.1.7.).

   ____

   ____

   ____

   ____

   ____________________ [__________]

3. A six storey parking garage with an office tower located above, is constructed and provided with a common elevator shaft. The third floor parking level is designated with parking spaces for wheelchair accessible vehicles.

   a) List the applicable Code references for the components below located in a barrier-free path of travel accessing the parking garage.

      i) building entrance
      ii) vehicle entrance and designated parking space
      iii) elevator shaft serving parking garage and office tower

      ____

      ____

      ______________________________ [____________]

   b) Based on your analysis, which storeys in the parking garage are not required to be provided with the clearance for a wheelchair accessible vehicle?

      ____

      ____

      ______________________________ [____________]

See Figure 11-2.

4. Consider a shopping mall with a public corridor and a food court area with public washrooms located within 45 m of the food court area. What are two possible options to meet the barrier-free washroom requirements?

   Possible options:

   ____

   ____________________________ [____________]

   ____

   ____________________________ [____________]

5. Consider a strip mall with individual mercantile suites. Which mercantile suites do not require a barrier-free washroom?

   ____

   ____

   ____

   ____________________________ [____________]

STOP

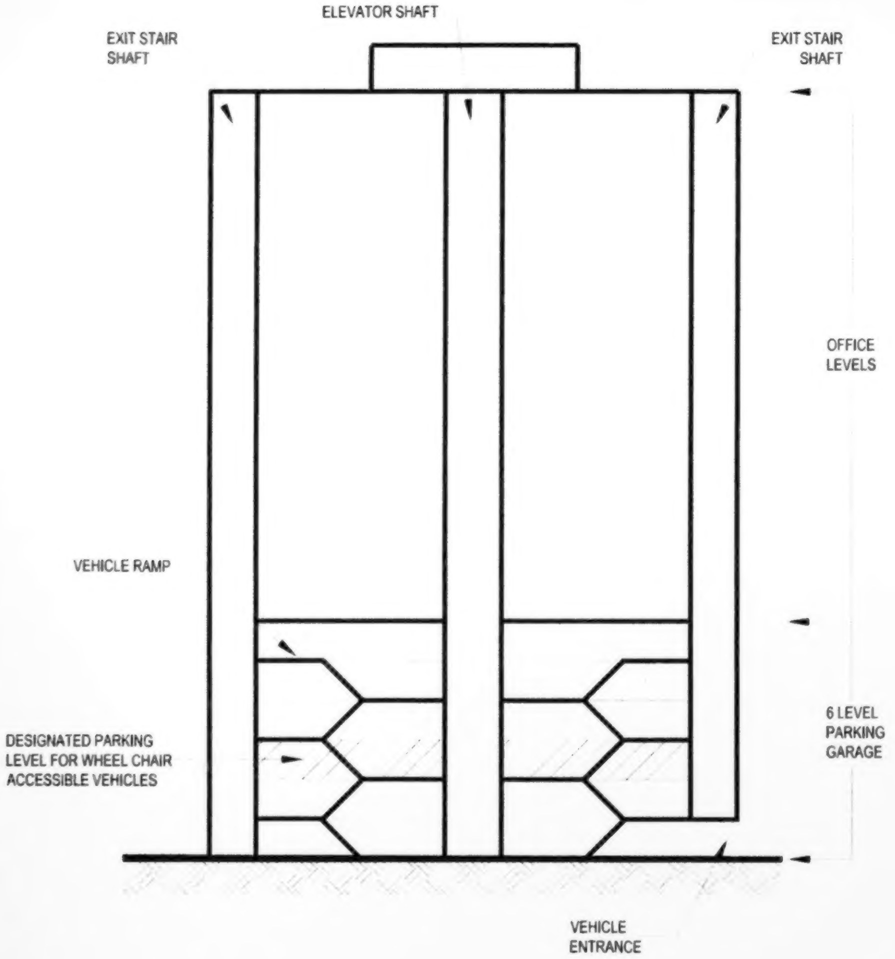

ELEVATOR SHAFT
EXIT STAIR SHAFT
EXIT STAIR SHAFT
OFFICE LEVELS
VEHICLE RAMP
6 LEVEL PARKING GARAGE
DESIGNATED PARKING LEVEL FOR WHEEL CHAIR ACCESSIBLE VEHICLES
VEHICLE ENTRANCE

FIGURE 11-2

11.5 DESIGN STANDARDS

Specific criteria is prescribed by the Code for the design of facilities provided in a barrier-free path of travel to serve persons requiring assistance. Major design components of Subsection 3.8.3. are identified for discussion purposes.

Doors and Doorways

All doorways in a barrier-free path of travel are required to provide a clear width of 850 mm [3.8.3.3.(1)]. Standard wheelchairs range from 584 mm to 685 mm in width.

Clear width is defined as the width of the doorway measured with the door in the open position. As such, the minimum width of a door in a barrier-free path of travel must be approximately 915 mm to ensure the minimum clear width of 850 mm (note that door widths may have to be increased to allow for any projecting exit hardware).

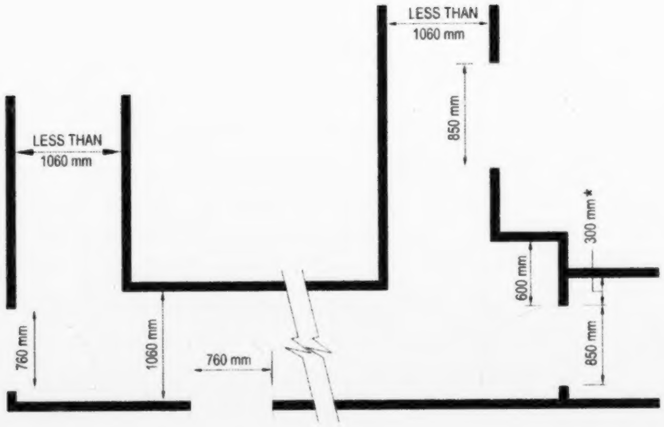
Sufficient clearance on the latch side of the door is required to permit a person in a wheelchair to approach and open a door where a door is equipped with a closer. Where a door swings away from the approach side, a 300 mm clearance to the latch side of the door is required. Where a door swings toward the approach side, a 600 mm clearance to the latch side of the door is required [3.8.3.3.(10)].

See Figure 11-3.

Where residential suites are located on a barrier-free storey, doorways serving bedrooms and washrooms are regulated although the remainder of the suite is not [3.8.3.3.(2)].

Corridor Width	Clear Doorway Width
less than 1060 m	810 mm
minimum 1060 m	760 mm

See Figure 11-4.


LESS THAN
1060 mm
850 mm
LESS THAN
1060 mm
300 mm*
600 mm
850 mm
760 mm
1060 mm
760 mm

* Note: Does not apply to residential suites not regulated by Sentence 3.8.2.1(4)

FIGURE 11-3

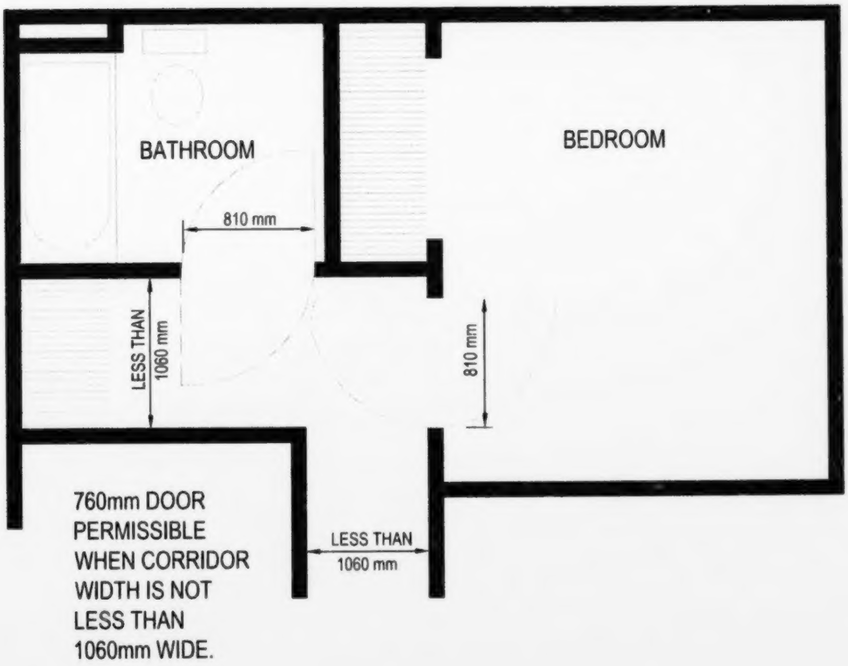

BATHROOM
BEDROOM
810 mm
LESS THAN 1060 mm
810 mm
760mm DOOR PERMISSIBLE WHEN CORRIDOR WIDTH IS NOT LESS THAN 1060mm WIDE.
LESS THAN 1060 mm

FIGURE 11-4

Power door operators are required for entrances serving hotels and care and treatment occupancies. Assembly/business and personal services/retail occupancies are required to be equipped with a power door operator if located in buildings that are greater than 300 m^2 in building area. However, if individual suites in buildings having only assembly/business and personal services/retail occupancies are completely cut off from the remainder of the building, and are less than 300 m^2 in area, a power door operator is not required [3.8.3.3.(5) to (6)].

Vestibules in a barrier-free path of travel are required to provide sufficient length between two doors in series. The minimum length between doors is 1200 mm plus the width of the door that swings into the vestibule [3.8.3.3.(11)].

Ramps [3.8.3.4.]

Ramps can be difficult to negotiate if the slope is too great or the length too long. Ramps in a barrier-free path of travel are not permitted to exceed a 1 in 12 slope. Ramps are permitted to extend a maximum of 9 m horizontally between level areas [3.8.3.4.(1)].

Level areas that divide ramps into intervals of not more than 9 m, are required to be at least 1670 mm long and at least the same width as the ramp. The top and bottom of ramps are required to have level areas that are at least 1670 mm long and 1670 mm wide. Ramps are required to have a minimum width of 900 mm between handrails.

See Figure 11-5.

Seating Areas [3.8.3.6.]

Assembly areas with fixed seating are required to provide designated seating for wheelchair use [3.8.2.1.(3)]. The floor slope required for a barrier-free path of travel is only intended to apply to the actual designated seating and aisles leading to the seating area. It is not intended to apply to aisles and floor areas serving fixed seating [3.8.3.6.(1)].

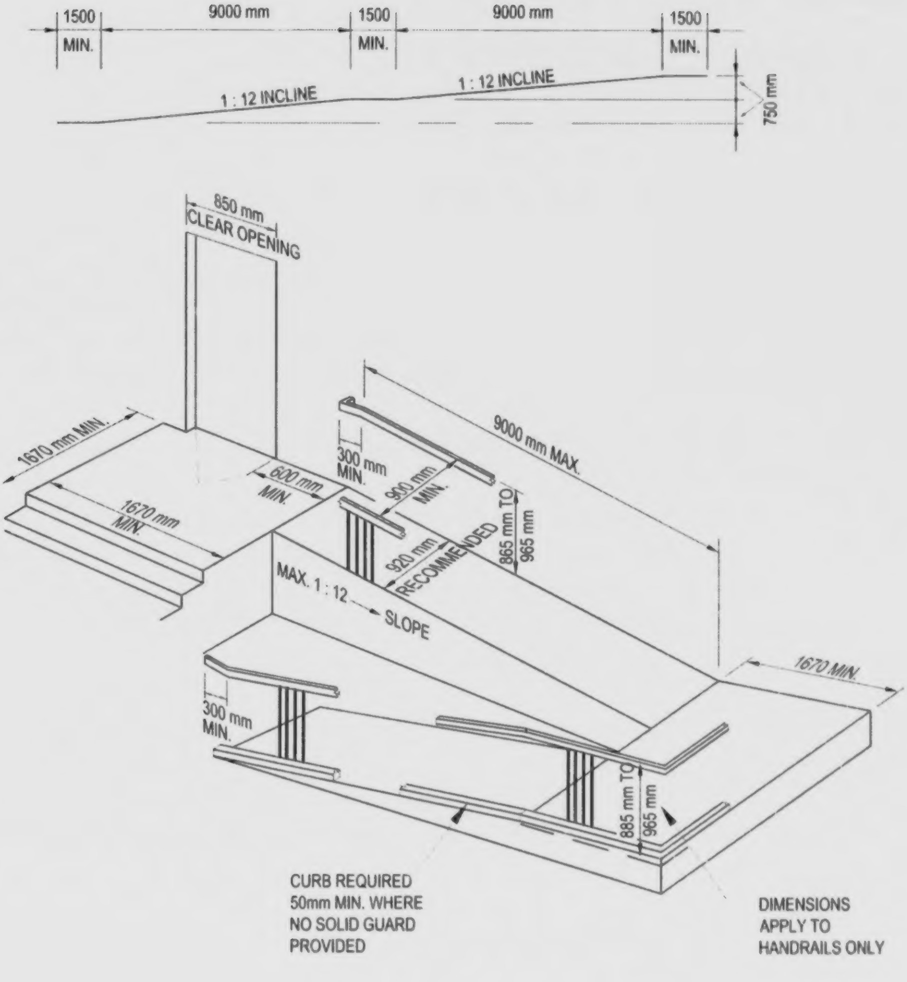

1500 MIN.
9000 mm
1500 MIN.
9000 mm
1500 MIN.
1 : 12 INCLINE
1 : 12 INCLINE
750 mm
850 mm CLEAR OPENING
1670 mm MIN.
600 mm MIN.
1670 mm MIN.
300 mm MIN.
900 mm MIN.
9000 mm MAX.
865 mm TO 965 mm
920 mm RECOMMENDED
MAX. 1 : 12 SLOPE
1670 MIN.
300 mm MIN.
885 mm TO 965 mm
CURB REQUIRED 50mm MIN. WHERE NO SOLID GUARD PROVIDED
DIMENSIONS APPLY TO HANDRAILS ONLY

FIGURE 11-5

Assistive Listening Devices [3.8.3.7.]

Assembly occupancies greater than 100 m^2 and with an occupant load of more than 75 people are required to be equipped with assistive listening systems [3.8.3.7.(1)].

Washrooms

Where barrier-free washrooms are required, at least one water closet is required to meet the dimensional requirements outlined in Articles 3.8.3.8. and 3.8.3.9., and lavatories are required to meet the requirements of Article 3.8.3.11. [3.8.3.8. and 3.8.3.11.].

Universal Toilet Rooms

Special washrooms are usually provided as unisex washrooms as an alternative to providing barrier-free washroom stalls in individual washrooms used by the general public. The dimensional requirements are outlined in Article 3.8.3.12.

Showers and Bathtubs

Assembly and care/treatment occupancies provided with individual shower stalls and bathtubs are required to be provided with at least one barrier-free shower stall and/or bathtub conforming to the dimensional requirements outlined in Article 3.8.3.13.

Shelves or Counters for Public Telephones

Public telephones provided with built-in shelves or counters are required to meet the dimensional requirements outlined in Article 3.8.3.15.

Drinking Fountains

Drinking fountains are required to meet the dimensional requirements outlined in Article 3.8.3.16.

STOP

EXERCISE #11-3

Take 20 minutes to answer the following questions located in Subsection 3.8.3.

1. What is the minimum height required for an exterior walk to be considered free of obstructions?

______________________________ [____________]

2. What is the minimum clear width of a door serving a bathroom in a barrier-free path of travel in a residential occupancy? How does the corridor width affect the door width?

____

____

______________________________ [____________]

3. What is the latch side clearance of a bathroom door located in a residential suite that swings towards the approach side? Explain.

____

____

______________________________ [____________]

4. Describe the provisions necessary for guards serving ramps so as not to facilitate climbing.

____

____

______________________________ [____________]

5. There are four designated spaces in a seating area serving 250 people. Each designated space is accessible at the same floor level as the points of entry into the assembly space. What specifically is excluded from the barrier-free path of travel within the seating area?

____

____

______________________________[______________]

See Figure 11-6.

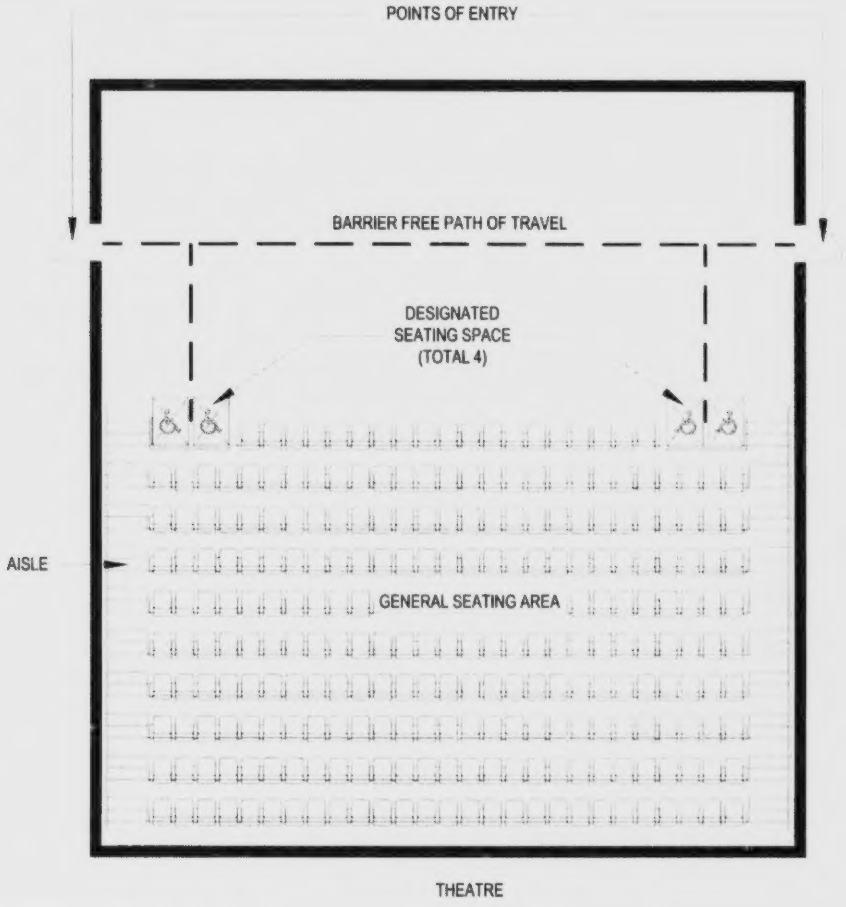

POINTS OF ENTRY
BARRIER FREE PATH OF TRAVEL
DESIGNATED SEATING SPACE (TOTAL 4)
AISLE
GENERAL SEATING AREA
THEATRE

FIGURE 11-6

6. What is the minimum clearance within a barrier-free water closet stall that will permit the stall door to swing into the stall?

   ____

   ____

   ______________________________ [______________]

7. Under what design conditions do water closets located in a barrier-free stall or washroom not require back supports?

   ______________________________ [______________]

8. What is the minimum dimension of a universal toilet room?

   ______________________________ [______________]

9. If a Group B occupancy contains individual shower stalls, what is the required mounting height of a folding seat that is not spring loaded and is located in a barrier-free shower?

   ____

   ______________________________ [______________]

10. A bank of five wall-hung public telephones is provided in a mall entrance vestibule. Telephones are provided with counters at varying heights. How many counters are required to provide knee clearance as part of the barrier-free design requirements? What is the maximum height of the telephone receiver measured from the top of the counter that is required to be barrier-free accessible?

    ____

    ______________________________ [______________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 12

LARGE BUILDINGS - 2006

PORTABLE CLASSROOMS AND SELF-SERVICE STORAGE BUILDINGS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

12.1 INTRODUCTION

Portable classroom refers to a building having an area of not more than 100 m^2 and not more than one storey in building height [3.9.3.1.(1)].

Self-service storage building, as defined, refers to a building used to provide individual storage spaces to the public.

This module will concentrate on requirements in the Building Code for the design and construction of portable classrooms and self-service storage buildings.

This module will include a list of defined terms relating to the content in this module. For a complete list of definitions, refer to the Code.

Objectives

- To provide an understanding of the Code requirements for portable classrooms and self-service storage buildings.
- To demonstrate comprehension of applicable Code requirements through the use of exercises.
- To identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.
- Students will learn where the relevant sections are located in the Code to gain a better understanding of spatial separations, fire alarm systems, exit requirements and provisions for firefighting in portable classrooms and self-service storage buildings.

Upon completion of this module, you will be able to:

- Calculate required minimum spatial separations,
- Find, understand and apply the provisions for firefighting,
- Be aware of the requirements for standpipe systems and fire alarm systems

for portable classrooms and self-service storage buildings.

STOP

12.2 OVERVIEW

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1, Article 1.4.1.2. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italicized text. While showing in italics in this section, terms will not be italicized throughout the remainder of this module.

Basement
Basement means a storey or storeys of a building located below the first storey.

Building area
Building area means the greatest horizontal area of a building above grade within the outside surface of the exterior walls or within the outside surface of exterior walls and the centre line of the firewalls.

Exit
Exit means that part of a means of egress, including doorways, that leads from the floor area it serves, to a separate building, an open public thoroughfare, or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare.

First storey
First storey means the storey with its floor closest to *grade* and having its ceiling more than 1.8 m above grade.

Flame-spread rating
Flame-spread rating means an index or classification indicating the extent of spread of flame on the surface of a material or assembly of materials as determined in a standard fire test, as prescribed in the Code.

Limiting distance

Limiting distance means the distance from an exposed building face to a property line, the centre line of a street, lane or public thoroughfare, or to an imaginary line between two buildings or fire compartments on the same property, measured at right angles to the exposed building face.

Major occupancy

Major occupancy means the principal occupancy for which a building or part of a building is used or intended to be used, and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy.

Means of egress

Means of egress means a continuous path of travel provided for the escape of persons from any point in a building or contained open space to a separate building, an open public thoroughfare, or an exterior open space protected from a fire exposure from the building having access to an open public thoroughfare. *Means of egress* includes exits and access to exits.

Mezzanine

Mezzanine means an intermediate floor assembly between the floor and ceiling of any room or storey and includes an interior balcony.

Noncombustible construction

Noncombustible construction means that type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies.

Public corridor

Public corridor means a corridor that provides access to exit from more than one suite.

Self-service storage building

Self-service storage building means a building that is used to provide individual storage spaces to the public and that is open to the public only for those purposes.

Smoke alarm

Smoke alarm means a combined smoke detector and audible alarm device designed to sound an alarm within the room or suite in which it is located upon the detection of smoke within that room or suite.

Storey

Storey means that portion of a building which is situated between the top of any floor and the top of any floor next above it, and if there is no floor above it, that portion between the top of such floor and the ceiling above it.

STOP

12.3 PORTABLE CLASSROOMS (Section 3.9)

General Overview

Portable classrooms shall be designed and installed in accordance with Section 3.9 of the Code. Interior wall and ceiling finishes shall have a flame spread rating of 150 or less [3.9.2.1.(1)].

A single portable classroom shall be not more than 100 m^2 in building area and not more than one storey in building height. A group of portable classrooms may be considered a single building if the distance between them is less than 6 m, with a building area equal to the aggregate area of the portable classrooms [3.9.3.1.(1) and (2)].

12.4 PORTABLE CLASSROOM SPATIAL SEPARATIONS
(Article 3.9.3.2.)

The requirement of Subsection 3.2.3. for spatial separation between individual portable classrooms need not apply if the distance between them is 6 m or more [3.9.3.2.(1)]. See Figure 12-1.

The requirement of Subsection 3.2.3. for spatial separation need not apply between portable classrooms in a group of portable classrooms if:

- the distance between them is less than 6 m,
- the number in the group is not more than 6, and
- the distance between groups is more than 12 m [3.9.3.2.(2)(a)], OR:

- the portable classrooms are in groups where the means of egress from the classrooms within the group is by a common corridor or passageway,
- there is not more than 6 portable classrooms in the group, and
- the distance between groups of portable classrooms is 12 m or more [3.9.3.2.(2)(b)].

Portable Classroom Spatial Separation

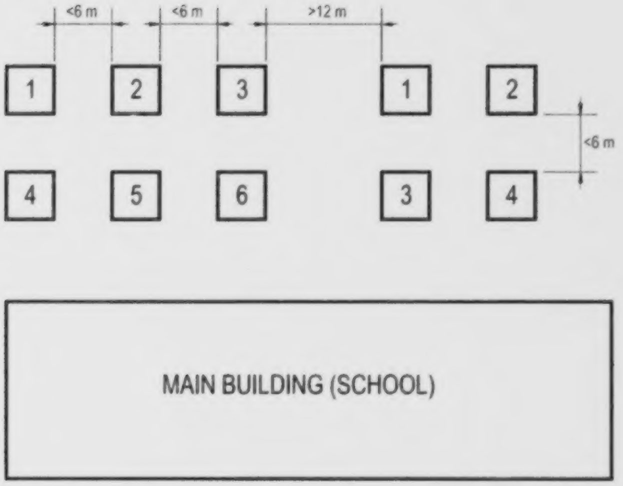

<6 m
<6 m
>12 m
1
2
3
1
2
<6 m
4
5
6
3
4
MAIN BUILDING (SCHOOL)

FIGURE 12-1

12.5 PORTABLE CLASSROOM FIRE ALARM SYSTEMS (Article 3.9.3.3.)

The fire alarm system in the main school shall be extended to the portable classrooms with a separate zone indicator unless:

- there is not more than 12 portable classrooms on the site and the distance between the portable classrooms is less than 6 m and the requirements of Subsection 3.2.3. are applied between the classrooms [3.9.3.3.(2)(b)], OR

- the distance between the classrooms is less than 6 m, not more than 6 portable classrooms in a group and the facing walls of the portable classrooms have a fire-resistance rating of 45 minutes. The distance between groups of classrooms must be at least 12 m [3.9.3.3.(2)(c)], OR

- the distance between portable classrooms is 6 m or more [3.9.3.3.(3)].

12.6 PORTABLE CLASSROOM PROVISIONS FOR FIREFIGHTERS (Article 3.9.3.4.)

Portable classrooms are not required to face a street nor firefighters' access provided if there are not more than 12 portable classrooms on the site and where:

a) The distance between them is 6 m or more.

b) The distance between portable classrooms is less than 6 m and the requirements of Subsection 3.2.3. are applied between classrooms.

c) The portable classrooms are in groups:

- where the distance between them is less than 6 m and the number of classrooms in a group is not more than 6, and within the group the facing walls have a fire-resistance rating of 45 min rated from the classroom side, and the distance between groups of classrooms is 12 m or more,

d) The portable classrooms are in groups where the distance between them is less than 6 m, and the number of classrooms in the group is not more than 6, and the distance between groups is 12 m or more, OR

e) The portable classrooms are in groups where:

- the means of egress for each classroom within a group is by common corridor or passageway,
- the number of classrooms in a group is not more than 6, and
- the distance between groups is 12 m or more [3.9.3.4.(1)].

12.7 PORTABLE CLASSROOM FUEL-FIRED APPLIANCES (Article 3.9.3.7.)

Where there is only one egress door from a portable classroom, a fuel-fired appliance shall be separated from the remainder of the classroom by a fire separation having a 45 min fire-resistance rating [3.9.3.7.(1)].

If the portable classroom contains a fuel-fired appliance, the appliance shall be separated by a 1.5 h fire separation where the horizontal distance between classrooms is 1500 mm or less, and a 45 min fire separation if the horizontal distance between classrooms is more than 1500 mm [3.9.3.7.(2)].

If the horizontal distance between portable classrooms is 6 m or more, a fuel-fired appliance need not be separated from the remainder of the classroom by a fire separation if there is not more than one appliance per portable classroom, and the appliance is located not less than 4.5 m from the egress doorway or an exit from the portable classroom [3.9.3.7.(3)].

Fuel-fired appliances with sealed combustion located in a portable classroom are not required to be separated from the remainder of the classroom if there is not more than four classrooms in a group and if the appliance is located not less than 4.5 m from an egress doorway or an exit from the portable classroom [3.9.3.7.(4)].

STOP

EXERCISE #12-1

Take 15 minutes to read Subsection 3.9.1. to 3.9.3. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain a consensus.

1. What is the maximum flame spread rating of a portable classroom?

   ______________________ [______________]

2. What is the maximum area of a portable classroom?

   ______________________ [______________]

3. What is the maximum number of portable classrooms allowed to be erected on a site before a fire alarm system has to be extended from the main school to the portable classrooms, if the portables are less than 6 m apart?

   ______________________ [______________]

4. In a portable classroom with a fuel-fired appliance located 5 m from the egress doorway, and where the horizontal distance between classrooms is 8 m, is the fuel-fired appliance required to be separated from the remainder of the classroom?

   ______________________ [______________]

STOP

12.8 SELF-SERVICE STORAGE BUILDINGS - GENERAL OVERVIEW (Section 3.10)

Major Occupancy

A self-service building shall comply with the requirements of a Group F, Division 2 major occupancy and shall not contain a Group F, Division 1 occupancy [3.10.2.1.(1)].

Construction

The first storey shall be divided into areas not more than 500 m^2 by masonry or reinforced concrete fire separations having a fire-resistance rating not less than 1 h, or shall be sprinklered [3.10.2.3.(2)].

Egress

Corridors are not required to be constructed as a public corridor where the travel distance measured from inside the rental space to the nearest exit is not more than 15 m, and provided the corridor walls are noncombustible construction, have no openings other than doors and the doors are solid construction and the walls are continuous from the floor to the underside of the floor above, the ceiling or the roof above [3.10.2.4.(2)].

Egress doors from the rental space are not required to swing in the direction of exit travel or swing on a vertical axis provided the area of the rental space is not more than 50 m^2 and the travel distance in the space is not more than 10 m [3.10.2.4.(4)].

Dead end corridors are not permitted [3.10.2.4.(7)].

The clear width of an exit stair in a self-service storage building shall not be less than 1100 mm [3.10.2.5.(2)].

Fire Separation

Not more than two dwelling units in a building. Dwelling units are required to be separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 2 hours [3.10.2.4.(9) and (10)].

Fire separations between individual rental storage spaces are not required [3.10.2.4.(12)].

A fuel-fired appliance shall be located within a service room separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 1 h [3.10.2.6.(2)].

Except as permitted in Sentences 3.7.4.1. (2) and (3), two washrooms with a water closet and lavatory shall be provided within one of the buildings on the property [3.10.2.7.(2)].

12.9 ADDITIONAL REQUIREMENTS FOR BUILDINGS CONTAINING MORE THAN ONE STOREY (Subsection 3.10.3.)

In self-service storage buildings that are more than one storey in building height, a fire alarm system shall be installed and manual pull stations are required in corridors on the first floor [3.10.3.3.(2) and (3)].

Access routes for fire department access shall be provided and shall be not less than 9 m wide [3.10.3.4.(2)].

In sprinklered buildings, hydrants shall be located along the access route so that the fire department pumper vehicle can be adjacent to it and an unobstructed path of travel for firefighters from the vehicle to the fire department connection is not more than 45 m [3.10.3.4.(3)(a)].

For buildings without a sprinkler system, hydrants shall be installed so that a fire department pumper vehicle can be located in the access route so that the unobstructed path of travel for firefighters is not more than 45 m from the hydrant to the vehicle and 45 m from the vehicle to every opening in the building [3.10.3.4.(3)(b)].

If a standpipe system is required by Subsection 3.2.9., hose stations are not required in the first storey [3.10.3.5.(1) and (2)].

12.10 ADDITIONAL REQUIREMENTS FOR ONE STOREY BUILDINGS (Subsection 3.10.4.)

For the purposes of Subsection 3.2.2., building area means the building area of each building, the total of the building areas of all buildings as a group or the total of the building areas of any number or group of buildings [3.10.4.2].

When referring to a group of buildings, the limiting distance requirements shall not apply between individual buildings [3.10.4.3.(2)].

The distance between individual buildings within a group shall be not less than 6 m [3.10.4.3.(4)].

When referring to more than one group of buildings, there is to be a limiting distance of 9 m minimum between each group of buildings, but not individual buildings in the group. Individual buildings within a group shall be not less than 6 m [3.10.4.3.(3) and (4)].

Access routes for fire department vehicles shall be 9 m wide and have hydrants situated along the route to provide compliance with Sentences 3.10.3.4.(3) [3.10.4.5.(1), (2), (3), (4) and (5)].

STOP

EXERCISE #12-2

Take 15 minutes to read Subsections 3.10.1. to 3.10.4. and answer the following questions. Provide Code references with answers where applicable. Discuss answers with your group to obtain consensus.

1. What occupancy must not be housed in a self-service storage building?

   ______________________ [______________]

2. In a nonsprinklered, single storey, self-service storage building, what is the maximum floor area of the storey before it is required to be subdivided?

   ______________________ [______________]

3. What is the maximum travel distance in a rental space which does not incorporate a public corridor?

   ______________________ [______________]

4. What is the minimum clear width of an exit stair in a self-service storage building?

   ______________________ [______________]

5. In a two storey, self-storage building, is a fire alarm system required?

   ______________________ [______________]

STOP

Ontario

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MODULE 13

LARGE BUILDINGS - 2006

PUBLIC POOLS AND PUBLIC SPAS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

13.1 INTRODUCTION

Public pool refers to a structure containing an artificial body of water for swimming or recreation.

Public pools do not include pools operated in conjunction with fewer than six dwelling units, suites or single family residences.

Public spas do not include wading pools, or spas operated in conjunction with fewer than six dwelling units, suites or single family residences.

Public spa refers to a hydro-massage pool for therapy and for recreational use.

This module will concentrate on requirements in the Building Code for the design and construction of public pools and public spas.

This module will include a list of defined terms relating to the content in this module. For a complete list of definitions, refer to the Building Code.

Objectives

Upon completion of this module, you will be able to:

- demonstrate comprehension of applicable Code requirements through the use of 'exercises',
- identify the respective Code requirements, and where required, to identify the Code references and demonstrate the procedure/method of obtaining your answer,
- demonstrate where the relevant sections are located in the Code,
- Expand on the subject of pool designations as well as pool and spa design and construction.

STOP

13.2 OVERVIEW

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. While defined terms are italicized in this section, they will not be throughout the remainder of this module.

Campground
Campground means land or premises used as an overnight camping facility other than a recreational camp.

Clean water
Clean water means water that has passed through a recirculation system.

Day camp
Day camp means a camp or resort that admits persons for a continuous period not exceeding 24 hours.

Diving board
Diving board means a flexible board.

Pool deck
Pool deck means the area immediately surrounding a public pool.

Public pool
Public pool means a structure, basin, chamber, or tank containing or intended to contain an artificial body of water for swimming, water sport, water recreation or entertainment but does not include:

a) pools operated in conjunction with less than six dwelling units, suites or single family residences or a combination of them,

b) pools that are used only for commercial display and demonstration purposes,
c) wading pools,
d) hydro-massage pools, or
e) pools that serve only as receiving basins for persons at the bottom of water slides.

Public spa

Public spa means a hydro-massage pool containing an artificial body of water that is intended primarily for therapeutic or recreational use, that is not drained, cleaned or refilled before use by each individual and that utilizes hydrojet circulation, air induction bubbles, current flow or a combination of them over the majority of the pool area, but does not include:

a) wading pools, or
b) spas operated in conjunction with less than six dwelling units, suites or single family residences or any combination of them, for the use of occupants or residents and their visitors.

Recirulation system

Recirculation system means a system that maintains circulation of water through a public pool by pumps, and that provides continuous treatment of the water, including filtration and chlorination or bromination and any other process that may be necessary for the treatment of the water.

Recreational camp

Recreational camp means a camp for recreational activities consisting of one or more buildings or other structures, established or maintained as living quarters with or without charge for ten or more persons, for temporary occupancy of five or more days.

13.3 PUBLIC POOLS (Section 3.11)

Public pools shall be designed and installed in accordance with Section 3.11.

This Section applies to the design and construction of site assembled and manufactured public pools [3.11.1.1.(2)].

Material alterations or repair to public pools or public pool equipment that effects the bottom slope, water volume or capacity of the recirculation system, the affected portions shall comply with the requirements of the Code [3.11.1.1.(3)].

13.4 DESIGNATION OF PUBLIC POOLS (Subsection 3.11.2)

Every public pool shall be designated as a Class A or Class B pool [3.11.2.1.(1)].

A Class A pool is:

- operated in conjunction with or as part of an educational, instructional, physical fitness or athletic institution or association supported by public funds, or
- operated as part of a recreational camp [3.11.2.1.(2)].

A Class B pool is operated in conjunction with:

- six or more dwelling units, suites, single family residences, or
- mobile home park or hotel or campground, or club or Group B occupancy [3.11.2.1.(3)].

13.5 POOL AND POOL DECK DESIGN AND CONSTRUCTION (Subsection 3.11.3.)

Class A and B pools shall be designed and constructed to comply with Article 3.11.3.1.

The slope of the bottom of a public pool is required to be determined relative to the water surface. Care must be taken that the depth is measured from the water surface level to the bottom of the pool and not from the top of the side of a pool to the bottom.

Pools are not usually designed to be filled to the top of the sides. This is a common error and if it is made, the steeper slope may begin before a water depth of 1350 mm is reached and the requirements of Sentence 3.11.3.1.(6) may not be met.

STOP

EXERCISE #13-1

Take 10 minutes and read Subsections 3.11.1 to 3.11.3 and answer the following questions.

1. A public pool operated by a mobile home park would be considered what Class of Pool?

   ______________________________[______________]

2. In general, a public pool shall have a minimum water depth of?

   ______________________________[______________]

3. What is a requirement for a public pool deck to prevent access from the public?

   ____

   ____

   ______________________________[______________]

4. When can an elevated platform be used instead of a pool deck?

   ____

   ____

   ______________________________[______________]

5. Every public pool shall have a sign posted notifying users of dangers associated with shallow water in pools with water depths below what depth?

   ____

   ______________________________[______________]

STOP

13.6 PUBLIC POOLS WITH DIVING BOARDS AND PLATFORMS (Subsection 3.11.4.)

Public pool diving boards or platforms and pool areas adjacent to these shall meet the provisions of Article 3.11.4.1.

For example:

- No diving board or platform shall be installed in a modified or wave action pool [3.11.4.1.(2)].
- Non slip surface [3.11.4.1.(3)].
- Handrail required > 600 mm above water [3.11.4.1.(4)].
- Pool depth in diving areas [3.11.4.1.(6), (7), (8) and (17)].
- Slope of bottom of pool [3.11.4.1.(8)].
- Horizontal distance between diving board and vertical projections [3.11.4.1.(10) and (11)].
- Diving board height [3.11.4.1.(12), (13), and (14)].
- Diving board projection dimensions [3.11.4.1.(15)].
- Diving boards higher than 3 m require a gate, barrier or other devise to prevent access [3.11.4.1.(16)].

13.7 RAMPS IN PUBLIC POOLS (Subsection 3.11.5.)

Ramps are permitted in public pools for the use of Group B, Division 2 or 3 major occupancies provided the water depth does not exceed 1500 mm and the water surface area does not exceed 100 m^2, to permit a bather with or without a wheelchair to enter the water [3.11.5.1.(1)].

Ramps shall have [3.11.5.1.(3)]:

- Handrails between 800 - 900 mm in height along each side of ramp.
- A width of at least 1100 mm.
- A curb or other means to prevent a wheelchair from falling off the sides of the ramp.
- Surface finishes capable of being kept clean, sanitary and free from slipperiness.
- A landing at the bottom at least 1500 mm in length and the same width as the ramp.

Curbs shall have [3.11.5.1.(6)]:

- A height of 50 mm.
- Rounded edges.
- A coved base, and
- Raised nosing at the top to serve as a fingerhold for bathers.

STOP

EXERCISE #13-2

Take 10 minutes to read Subsections 3.11.4. and 3.11.5. and answer the following questions.

1. What must a diving board in a public pool that is more than 600 mm above the water surface be equipped with?

   ______________________________ [______________]

2. What is the horizontal distance between the centre line of the diving platform and the closest vertical projection of a ledge where the platform is 500 mm above the water surface?

   ______________________________ [______________]

3. What is the minimum height of a handrail used on a ramp in a Group B Division 2 pool?

   ______________________________ [______________]

4. Is a curb required in a Group B Division 2 pool? If so, what is the curb height?

   ______________________________ [______________]

STOP

13.8 MODIFIED POOLS/WAVE ACTION POOLS (Subsections 3.11.6. & 3.11.7.)

Modified pools shall be designed to conform with Sentences 3.11.6.1.(3) to (9), [3.11.6.1.(2)]

Wave action pools shall be designed to conform with Sentences 3.11.7.1.(3) to (11), [3.11.7.1.(2)]

See Figure 13-1.

EXERCISE #13-3

Take 10 minutes to read Subsections 3.11.6. and 3.11.7. and answer the following questions.

1. What is the maximum slope of the bottom of a modified pool?

   ______________________ [______________]

2. What type of markings are required on the bottom of a modified pool?

   ______________________ [______________]

3. How many life guard control stations are required on each side of a wave action pool with a water depth of 1500 mm?

   ______________________ [______________]

4. In a wave action pool, what is the maximum distance a first aid room is permitted to be separated from the pool?

   ______________________ [______________]

STOP

Sentence 3.11.7.1.(11)

WAVE ACTION POOL EXAMPLE

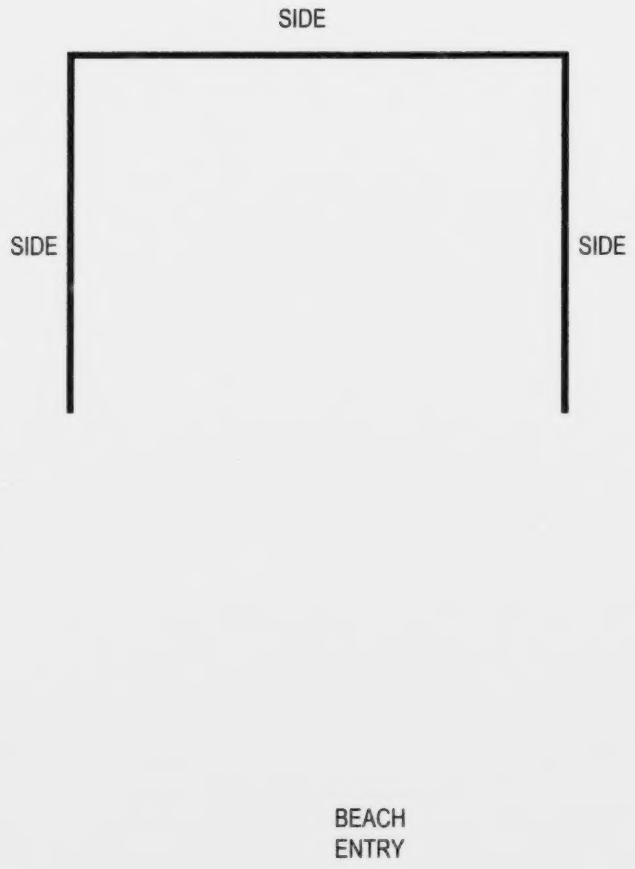

SIDE
SIDE
SIDE
BEACH
ENTRY

FIGURE 13-1

13.9 RECIRCULATION IN POOLS (Subsection 3.11.8.)

Recirculation systems shall be designed and constructed to comply with Sentence 3.11.8.1.(4).

Every public pool shall be equipped with a recirculation system. The recirculation system of a public pool shall be capable of filtering and disinfecting pool water at an adequate rate depending on pool type, at an adequate rate depending on pool type as described in Sentence 3.11.8.1.(5).

Equipment shall be installed to continuously disinfect the water in a public pool [3.11.8.1.(8)].

Exposed potable water piping and chlorine piping within a public pool water treatment service room shall be colour coded [3.11.8.1.(10)].

13.10 DRESSING ROOMS, LOCKER FACILITIES AND PLUMBING FACILITIES (Subsection 3.11.9.)

Public pools shall be equipped with dressing rooms, locker rooms, shower heads, water closets, urinals, lavatories and drinking fountains which comply with Sentences 3.11.9.1.(4) to (14).

For example:

- One shower head is required for every 40 bathers [3.11.9.1.(5)].
- Shower heads shall be supplied with potable water of at a pressure of at least 140 kPa [3.11.9.1.(7)].
- Dressing and locker room floors shall have non-slip surfaces that permit convenient and thorough cleaning and disinfecting [3.11.9.1.(14)].

Sentences 3.11.9.1.(2) and (3) provide exceptions to the above for Class A and B pools.

The minimum required number of water closets, urinals and lavatories shall be determined from Article 3.7.4.3. and Table 3.7.4.3.C [3.11.9.1.(4)].

The occupant load of a public pool or wave pool is determined in Article 3.1.17.3.

13.11 EMERGENCY PROVISIONS FOR PUBLIC POOLS (Subsection 3.11.10.)

Illumination levels for public spaces shall conform to Subsection 3.2.7 except that dressing rooms, locker rooms, shower rooms, washrooms and passageways shall have an illumination level of at least 200 lx at floor level [3.11.10.1.(1) and (2)]. Emergency power supply for emergency lighting shall comply with Sentences 3.2.7.4.(1) and 3.2.7.7.(1) and Article 3.2.7.5. [3.11.10.1.(6)].

All Class A pools shall be equipped with an emergency phone. [3.11.10.1.(7)]

Class B pools are required to have an emergency phone installed within 30 m of the pool. [3.11.10.1.(8)]

Wave action pools require a communication systems, which includes communication to life guard station, first aid room and the bather administration control centre [3.11.10.1.(10)].

Emergency stop buttons for pool recirculation systems, are required beside the phone in Class A pools and on the pool deck in a Class B pool [3.11.10.1.(12)].

Subsection 3.11.10. covers most of the areas that are related to pool design. Any other accompanying facilities that are part of the function of a public pool shall comply to the requirements of Subsection 3.2.7. [3.11.10.1.(1)]. An example of this would be where an observation gallery overlooks a public pool. The gallery would have to comply with the requirements of 3.2.7., not to 3.11.10.

Care must be taken when locating underwater lights so that no shadows will be cast in the deep area of the pool.

13.12 SERVICE ROOMS AND STORAGE FOR PUBLIC POOLS (Subsection 3.11.11.)

Service rooms shall comply with Sentences 3.6.2.1.(5), 3.6.2.1.(7) and 3.6.2.1.(8); and Articles 3.5.3.3 and 3.6.2.2. [3.11.11.1.(1)].

Storage facilities shall be provided for the safe storage of all chemicals required in pool operations [3.11.11.1.(3)].

Compressed chlorine gas shall be located in a service room that:

- Except as provided by Sentences 3.1.9.4.(3) to (8), is separated by a 1 h fire separation and that is substantially gas tight.
- Designed for the sole purpose of containing all pressurized chlorine gas apparatus, containers or cylinders.
- Is located at or above ground level.
- Has an exterior exit door – opening to the outdoors.
- Has screened openings.
- Is equipped with an emergency mechanical ventilation system.
- Contains a weigh scale of at least 135 kg capacity [3.11.11.1.(2)].

Storage facilities shall be ventilated and equipped with a water hose connection and a floor drain [3.11.11.1.(4)].

STOP

EXERCISE #13-4

1. In a Class B pool what is the volume of water required to be filtered and disinfected each day?

   ____

   ____________________ [__________]

2. Are water closets required for a Class A pool on the premises of a recreation camp if similar facilities are available elsewhere on the premises?

   ____

   ____________________ [__________]

3. What are the illumination requirements for an outdoor pool deck after dark?

   ____

   ____________________ [__________]

4. What is the air exchange volume requirement for mechanical ventilation in a service room where compressed chlorine gas is stored?

   ____________________ [__________]

13.13 PUBLIC SPA, SPA DECK AND RAMP DESIGN AND CONSTRUCTION (Subsections 3.12.1., 3.12.2. and 3.12.3.)

Section 3.12 applies to the design and construction of site assembled public spas, factory built public spas and material alterations that effect the bottom slope, water volume or capacity of the circulation system [3.12.1.1.(1) and (2)].

In addition to the requirements of Subsection 3.12.2., public spas shall comply with the requirements of Sentences 3.11.3.1.(13) to (17), (19), (20) and (22), and Clause 3.11.3.1.(24)(a) [3.12.2.1.(1)].

A public spa shall not have a depth of more than 1200 mm nor a bottom slope of more than 8% [3.12.2.1.(2) and (3)].

All spas shall be surrounded by a hard surfaced pool deck [3.12.2.1.(4)].

Dressing rooms, water closets and showers shall be provided on the premises where a spa is operated [3.12.2.1.(8)].

EXERCISE #13-5

1. What is the maximum depth of water for a public spa?

   ______________________________ [______________]

2. List three things a set of steps providing entry and egress from a public spa are required to have.

   ____

   ____

   ______________________________ [______________]

STOP

13.14 WATER CIRCULATION FOR PUBLIC SPAS (Subsection 3.12.4.)

Subsection 3.12.4. and Sentences 3.11.8.1.(2), (3), (6), (7), (9), (10), (11), (13) and (20) set requirements for water circulation systems for public spas [3.12.4.1.(1)].

All public spas shall be provided with a water circulation system which is capable of filtering and disinfecting the spa water [3.12.4.1.(2)].

Every circulation system in a spa shall be served by a minimum of two suction or gravity outlets except for a factory built spa with multiple openings that connect to a full size manifold [3.12.4.1.(4)].

A spa equipped with hydro-massage jet fittings shall be provided with a timing device. The water circulation system for a spa shall be capable of both completely and partially draining and refilling the spa water [3.12.4.1.(16) and (18)].

13.15 EMERGENCY PROVISIONS FOR PUBLIC SPAS (Subsection 3.12.5.)

In a public spa an emergency telephone directly connected to an emergency service or to the local telephone utility shall be installed within 30 m of the spa [3.12.5.1.(2)].

All public spas shall have an emergency stop button that is clearly labeled and located within the immediate vicinity of the spa [3.12.5.1.(3)].

13.16 SERVICE ROOMS AND STORAGE FOR PUBLIC SPAS (Subsection 3.12.6.)

Service rooms and storage facilities for all public spas shall comply with the requirements of Article 3.11.11.1. [3.12.6.1.(1)].

EXERCISE #13-6

1. A water circulation system for a public spa with 5 m^3 of water volume shall be capable of disinfecting and filtering the water contained therein with a turnover period of how many minutes?

   ________________________ [______________]

2. What is the maximum water velocity in a copper pressure pipe?

   ________________________ [______________]

3. Emergency telephones are required to be connected to an emergency service or the local telephone utility and installed within how many metres of the spa?

   ________________________ [______________]

4. What is the minimum fire-resistance rating of a fire separation separating a compressed chlorine gas service room from the remainder of the building in a public spa?

   ________________________ [______________]

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 14

LARGE BUILDINGS - 2006

RAPID TRANSIT STATIONS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

14.1 INTRODUCTION (Section 3.13)

Rapid transit station, as defined in the Building Code, means a building or part of a building used for the purpose of loading and unloading passengers of a rapid transit system but does not include open air shelters at street level.

This module will focus on the design standards applicable to a rapid transit station with emphasis on construction and safety requirements, as outlined in Section 3.13 of the 2006 Building Code. It only applies to electrified systems.

Objectives

- To provide an understanding of the Code intent and application of the rapid transit station requirements.
- To demonstrate comprehension of applicable Code requirements through the use of 'exercises'.
- To identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.

Upon completion of this module, you will be able to:

- Determine to what extent the construction and safety requirements are applicable to a specific type of rapid transit station.
- Understand the design standards applicable to different components that form part of a rapid transit station.

14.2 OVERVIEW

The following definitions are taken from Article 3.13.1.2. While italicized in this section, they will not be italicized in the remainder of this module.

Definitions

Ancillary

Ancillary space means the rooms or spaces in the station used only by the transit agency to house or contain operating, maintenance or support equipment and functions, but does not include booths and kiosks used by the transit agency or service rooms.

Central supervising station

Central supervising station means the operations centre where the transit agency controls and coordinates the system-wide movement of passengers and vehicles and from which communication is maintained with supervisory and operating personnel of the transit agency and with participating agencies when required.

Crush load

Crush load means the total of the seating capacity and the standing capacity of a car where:

a) the seating capacity is the number of seats in a car, and
b) the standing capacity is 0.2 m^2 per person for the standing area which is measured 300 mm in front of the seats.

Egress capacity

Egress capacity means the number of people able to travel from or through a type of egress facility in a specified period of time.

Entraining load

Entraining load means the number of passengers boarding the train at a station.

Fare-paid area

Fare-paid means that portion of a rapid transit station to which access is gained by a pass or by paying a fare.

Fare-paid area control

Fare-paid area control means the point where passengers enter or leave the fair-paid area.

Link load

Link load means the number of passengers on board the train(s) travelling between two stations.

Maximum calculated train load

Maximum calculated train load means the crush load per car multiplied by the maximum number of cars per train in the peak period.

Peak direction

Peak direction means, for each route, the direction of train travel having the largest passenger flow volume based on the sum of the incoming link load plus the entraining load per peak hour.

Protected route

Protected route means that portion of a means of egress which starts at the point where passengers would not be vulnerable to exposure from a train fire and which leads to the exterior of the station or through an exit to an adjacent building.

Public area

Public area means the public circulation areas in a rapid transit station providing pedestrian access to and from trains.

Rapid Transit Stations

Rapid transit stations means a building or part of a building used for the purpose of loading or unloading passengers of a rapid transit system but does not include open air shelters at street level.

Rapid transit system

Rapid transit system means an electrified transportation system, utilizing guidance methods involving positive mechanical contact with the fixed way operating on a right-of-way for the mass movement of passengers.

General Overview

The Code is applicable to the construction of new and existing stations and vehicle terminals. Section 3.13 addresses the requirements for rapid transit stations. Where a specific code requirement is not referenced, other parts of the Code are applicable.

The Code does not apply to tunnels or guideways between stations.

Occupancy Classification

Under the definition of assembly occupancies in Div. A, Article 1.4.1.2., rapid transit stations are classified as Group A Division 2 assembly occupancies. An occupancy that is related to the operation of a rapid transit system is classified as a subsidiary occupancy.

Subsidiary occupancies include:

- service rooms
- ancillary spaces
- booths and kiosks
- leased areas.

Rapid Transit Stations

Rapid transit stations are defined as either enclosed or unenclosed for purposes of prescribing construction and ventilation requirements. An unenclosed station, as defined by NFPA 130, "Fixed Guideway Transit Systems", is a station that is constructed in such a manner that it is open to the atmosphere, and smoke and heat are allowed to disperse directly into the atmosphere [3.13.7.1.(1)].

From this definition, it can be concluded that unenclosed stations can physically disperse smoke and heat by natural means. Enclosed stations, however, are required to be provided with emergency ventilation by mechanical means.

Vehicle Terminals

Vehicle terminals are also defined as either enclosed or unenclosed. An unenclosed vehicle terminal is configured to provide cross ventilation by natural means and is required to have a minimum of 25% of the total area of its perimeter walls open to the outdoors (refer to 'open-air storey' definition) [Division A, Sentence 1.4.1.2.(1)].

Enclosed vehicle terminals are terminals not meeting the definition of an unenclosed terminal, and are provided with direct access to a rapid transit station. Enclosed terminals are required to be provided with ventilation in conformance with Article 6.2.2.3.

STOP

14.3 CONSTRUCTION AND FIRE SEPARATION REQUIREMENTS (Subsections 3.13.2, 3.13.3., 3.13.4.)

Rapid transit systems are required to be of noncombustible construction. The only exception is exterior combustible canopies which are permitted to be located above stairs extending to street level [Sentences 3.13.2.1.(3), (4), (5) and (6)].

Construction

The structural protection for stations is described in Article 3.13.2.1. and is summarized in the table below.

Structure	Stations constructed Above and Below Grade or Entirely Below Grade	Stations Constructed Entirely Above Grade
Floor assembly	2 h [a] [3.13.2.1.(3)]	1 h [a] [3.13.2.1.(6)]
Roof assembly	1 h (stations with above and below grade portions) [b] [3.13.2.1.(5)] OR 2 h (stations entirely below grade) [c] [3.13.2.1.(3)]	1 h [b] [3.13.2.1.(11)]
Loadbearing walls, columns and arches	at least equal to supported assembly [3.13.2.3.(c)]	

Notes:

[a] exception for
- stairs and escalators [3.13.2.1.(7)]
- elevator shafts [3.13.2.1.(8)]
- other openings [3.13.2.1.(9)]

[b] not required to be constructed as a fire separation [3.13.2.1.(11)(c)]

[c] no fire-resistance rating required where steel tunnel liners for roof are provided and in direct contact with soil [3.13.2.1.(3)(b)(ii)]

Fire separations are generally based on separating a public means of egress from non-public areas.

Fire separation requirements are essentially based on the concept that all public circulation areas constitute part of the means of egress from the station and that non-public areas which may contain combustible materials and which are visually separated from the public areas should be fire separated from the means of egress.

Fire separation requirements are outlined in Subsections 3.13.2., 3.13.3., and 3.13.4.

Floor Area	Fire Separation
Service rooms	1 h [a] [b] [3.13.3.1.(1)]
Ancillary spaces	1 h [a] [3.13.3.3.(1)]
Booths and kiosks greater than 20 m^2	non-rated, noncombustible fire separation [c] [3.13.3.2.(2)]
Booths and kiosks less than or equal to 20 m^2	no fire separation required [3.13.3.2.(1)]
Leased areas (sprinklered)	non-rated, noncombustible fire separation [3.13.3.4.(1)]
Connection between station and adjacent building	2 h [3.13.3.6.(1)]
Connection between station vehicle terminal (enclosed)	1 h [d] [3.13.3.5.(1)] sprinklered

Notes:

[a] Where several rooms of this type are grouped together, a fire separation around the perimeter of these rooms is permitted rather than each room.

[b] Where a service room is sprinklered, or contains limited service equipment that does not constitute a fire hazard, a fire separation is not required [3.6.2.2.(4) and (5)]

[c] Booth/kiosk is also required to be sprinklered [3.13.3.2.(2)(a)]

[d] Wired glass assemblies can be used in lieu of a 1 h fire separation [3.13.3.5.(1)(b)(ii)]

STOP

EXERCISE #14-1

1. Using Figure 14-1, what is the required fire-resistance rating of the assemblies shown? (Give Code reference)

Assembly A: ____________________ [____________________]

Assembly B: ____________________ [____________________]

Assembly C: ____________________ [____________________]

2. What is the exception to vestibule doors located in a 1 h fire separation or wired glass assembly between a rapid transit station and an adjacent building?

____

____________________________ [______________]

3. Vestibule doors which separate a rapid transit station from an adjacent building are permitted to swing in either direction. True or False?

____

____________________________ [______________]

4. What provisions specifically do not apply to a vestibule which connects a rapid transit station to an adjacent building?

____

____________________________ [______________]

STOP

Fire-Resistance Rating [Article 3.13.2.1.]

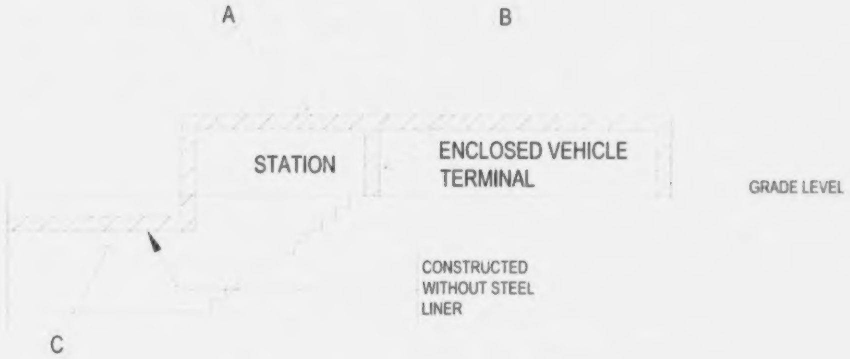

A
B
STATION
ENCLOSED VEHICLE TERMINAL
GRADE LEVEL
CONSTRUCTED WITHOUT STEEL LINER
C

FIGURE 14-1

14.4 MEANS OF EGRESS (Subsection 3.13.4.)

Means of egress is addressed in Subsection 3.13.4.

The Code assumes that an emergency condition originates on-board a train arriving at the station platform and the emergency ventilation requirements are designed for this as a worst case scenario.

Enclosed rapid transit stations are required to provide a tenable environment for the evacuation of passengers by means of a protected egress route and emergency ventilation. The protected route is considered to begin at the point where passengers would not be vulnerable to exposure from a train fire.

Protected routes are required to be provided with emergency ventilation and one of the following for enclosed or underground stations [3.13.4.2.(7)]:

- 1 h fire separation
- 1 h rated construction
- wired glass assembly.

In an aboveground, unenclosed station, the protected route is permitted to begin at the point of leaving the platform [3.13.4.2.(6)].

Occupant Load

The platform occupant load determines the capacity of the egress facilities serving the platform level and protected route. Occupant load is based on the sum of the maximum train capacity in with the a.m. or p.m. peak periods and the entraining load on the platform waiting for a train [3.13.4.1.].

Number and Location of Means of Egress

Each platform is required to be served by not less than two means of egress which are separate and remote from one another [3.13.4.3.(1)].

Egress routes from the platform level are required to separated by 25 m or the length of a car, whichever is greatest [3.13.4.3.(3)]. This is also considered the minimum distance between two egress routes.

The travel time from any point on the platform to a protected route is not more than 4 minutes [3.13.4.3.(5)].

Egress Capacity

The means to calculating egress capacity is described in 3.13.4.4.

The required aggregate egress capacity for a rapid transit station is based on the platform occupant load divided by the clearance time (i.e. number of people/minute). Clearance time is the time remaining when the travel time to get to a protected route is subtracted from the maximum 4 minutes available. The greater the travel time to get to a protected route, the greater the egress capacity that is required [3.13.4.4.(1) and (3)].

Egress routes that converge at a point are considered to have a cumulative egress capacity beyond that point [3.13.4.4.(5)].

Width of Means of Egress

The required aggregate width of a means of egress is based on the required egress capacity and will depend on the pedestrian flow rate for the type of egress facility and the clearance time available [3.13.4.5. and Table 3.13.4.5].

To calculate egress capacity for a specific egress facility (i.e. stair, corridor, etc.), utilize the following formula:

Capacity of egress facility = flow rate x clearance time x egress width

The minimum width of egress facilities serving platforms is described in Sentences 3.13.4.5.(4) and (5):

- 1750 mm for corridors, ramps and stairs
- 430 mm for turnstiles
- 500 mm for collection gates
- 600 mm nominal width for escalators
- 900 mm for a door leaf
- 1100 mm for a second means of egress.

EXERCISE #14-2

Using Figure 14-2, analyze the information provided and calculate the following:

Given:

- capacity of egress facility = flow rate x clearance time x egress width
- travel time to a protected egress route is 0.75 minutes
- clearance time is 3.25 minutes (i.e. 4 - 0.75 minutes)
- total egress width is 5 metres.

1. What is the maximum permitted capacity based on the pedestrian flow rate for stairs?

   ____

   ______________________________[______________]

2. What is the maximum permitted capacity if the total egress width is increased to 7 metres in question 1.?

   ____

   ______________________________[______________]

STOP

Means of Egress [Article 3.13.4.5.]

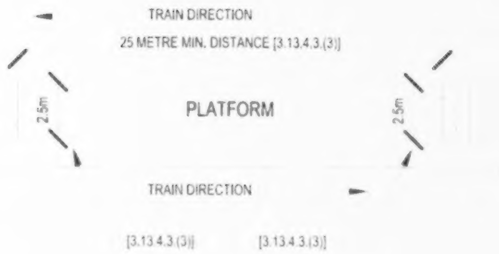

TRAIN DIRECTION
25 METRE MIN. DISTANCE [3.13.4.3.(3)]
2.5m
PLATFORM
2.5m
TRAIN DIRECTION
[3.13.4.3.(3)]
[3.13.4.3.(3)]

FIGURE 14-2

14.5 FIRE SAFETY PROVISIONS (Subsection 3.13.5.)

The early warning and fire suppression systems are described in Subsection 3.13.5.

A fire alarm system provides early warning. The components of the fire alarm system required for a rapid transit station are as follows:

• fire detectors	[3.13.5.3.]
• central supervising station	[3.13.5.4.]
• annunciator	[3.13.5.5.]
• emergency power	[3.13.5.7.]
• communication system	[3.13.5.8.]
• emergency reporting devices	[3.13.5.9.]

There are two types of required fire suppression systems:

• sprinkler system	[3.13.5.10.]
• standpipe and hose system	[3.13.5.11.]

The following are examples of areas that are required to be sprinklered:

- enclosed vehicle terminals (bus or park-and-ride) [3.13.3.5.(1)]
- vestibule access to adjacent building [3.13.3.6.(4)]
- collectors' booth greater than 20 m^2 [3.13.3.2.(2)]
- service rooms opening into an egress path less than 5 m wide [3.13.3.3.(2), (3) and (4)]
- leased areas [3.13.3.4.(1)]
- combustible refuse rooms [3.13.1.1.(1) and 3.6.2.6.(1)]
- steel truss escalator enclosure [3.13.5.10.(2)].

EXERCISE #14-3

Take 5 minutes to answer the following questions:

1. In accordance with Article 3.13.5.2., what are the exceptions to Subsection 3.2.4., "Fire Alarm and Detection Systems"?

   ____

   ____________________________ [______________]

2. In accordance with Article 3.13.5.9., under what circumstances are public telephones permitted to be used as emergency reporting devices?

   ____

   ____

   ____________________________ [______________]

3. In accordance with Sentence 3.13.5.11.(6), what exemption exists for fire hose cabinets?

   ____

   ____

STOP

14.6 REQUIRED SANITARY FACILITIES (Subsection 3.13.6.)

Generally, washrooms are only provided for use by employees present during operating hours, with the exception of stations located at the end of the line which are required to be provided with public washrooms [3.13.6.2.].

EXERCISE #14-4

Read Article 3.13.6.2. and answer the question below.

1. All rapid transit stations are required to be provided with employee washrooms. True or false?

   ____

   _________________________ [______________]

STOP

14.7 BARRIER-FREE DESIGN (Subsection 3.13.8.)

A barrier-free path of travel is required from at least one main entrance to the following areas:

- fare-paid area, and
- all platforms [3.13.8.1.(2)]

Elevators are required to meet the barrier-free design requirements specified in Articles 3.13.8.2. to 3.13.8.4.

Washrooms are required to meet the barrier-free requirements specified in Article 3.13.8.5.

EXERCISE #14-5

Answer the following questions.

1. In accordance with Sentence 3.13.8.2.(1), when are elevators exempt from meeting the barrier-free requirements outlined in 3.3.1.7.(1)(a)?

   ____

   ____________________________ [____________]

2. In accordance with Sentence 3.13.8.5.(3), a washroom containing more than one water closet is required to be designed such that each water closet is barrier-free. True or false?

   ____

   ____________________________ [____________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

FACILITATOR'S MODULE 15

LARGE BUILDINGS - 2006

TENTS

AIR-SUPPORTED STRUCTURES

SIGNS

SHELF AND RACK STORAGE SYSTEMS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

15.1 INTRODUCTION (Sections 3.14, 3.15 and 3.16)

TENTS

Tents and air supported structures are required to conform to life safety requirements similar to buildings regulated by the Code.

Tents typically are used as temporary structures for special events over relatively short periods of time (i.e. one day to a few weeks or more).

Air-supported structures may be erected on a seasonal or permanent basis located adjacent to or adjoining an existing building (i.e. golf domes, tennis courts, garden centres).

Tents and air-supported structures are required to be constructed of flame resistant material, conform to spatial separation requirements, provide a means of egress to an exit and provide firefighting access [3.14.1.2., 3.14.1.3., 3.14.1.4., 3.14.1.5., 3.14.1.6., 3.14.1.9., 3.14.2.1., 3.14.2.2., 3.14.2.3., 3.14.2.4., 3.14.2.5. and 3.14.2.6.].

SIGNS

Signs are an important tool for advertisers and companies to display their products or for the identification of their business (i.e. building faces, interior malls, rooftops).

The location and construction of signs are subject to specific structural design requirements and clearances to or near public areas [Section 3.15].

SHELF AND RACK STORAGE

Section 3.16 of the Code applies to shelf and rack storage systems. The requirements of this section refer to prescriptive requirements for construction, means of egress, lighting, signs and sprinkler systems.

This module will concentrate on requirements in the Building Code for tents, air-supported structures, signs and shelf and rack storage. For the purpose of this module, tents and air-supported structures are located in Part A, signs are located in Part B, and shelf and rack storage in Part C of this module.

This module will include a list of defined terms relating to the content herein. For a complete list of definitions, refer to the Code.

Objectives

- To assist in finding, understanding and applying the Code requirements that regulate the requirements for tents, air-supported structures, signs and shelf/rack storage systems.
- To demonstrate comprehension of applicable Code requirements through the use of exercises.
- To identify the respective Code requirements, and where required, to identify the Code references and to demonstrate the procedure/method of obtaining your answer.

Upon completion of this module you will be able to:

- Understand general requirements for tents and air-supported structures, shelf and rack storage, and identify requirements for exterior and interior signs.
- Identify the differences between a tent and an air-supported structure.
- Understand general requirements for shelf and rack storage systems.

STOP

PART A

15.2 OVERVIEW (Sections 3.14, 3.15 and 3.16)

Read to next STOP sign.

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italicized text. While shown in italics in this section, defined terms will not be italicized throughout the remainder of this module.

Air-supported structure
Air-supported structure means a structure consisting of a pliable membrane which achieves and maintains its shape and support by internal air pressure.

Walkway
Walkway means a covered or roofed pedestrian thoroughfare used to connect two or more buildings.

Shelf and rack storage system
Shelf and rack storage system means a self-contained structural system within a building, having one or more elevated platforms or walkway levels for personnel access that may also support conveyors and other material handling storage and distribution equipment.

General Overview

Tents and air-supported structures are structures typically covered with a fabric type membrane.

Tents and air-supported structures have a wide range of use for public and private applications.

A tent is generally used for private and public use on a temporary basis, whereas an air-supported structure is generally used for public use on a seasonal basis or as a permanent structure.

A sign may be located on the exterior face of a building, located on a rooftop (billboard) or within an interior mall space.

Depending on the location, a sign requires special attention with respect to professional design, location and clearance relative to public spaces.

A shelf and rack storage system may contain various types of materials representing potential hazards within a building.

The design and review of tents, air-supported structures, signs, and shelf and rack storage systems, have architectural, fire and public safety implications.

STOP

15.3 TENTS (Subsection 3.14.1.)

General Requirements

Tents come in different forms and sizes depending on their intended use and anticipated occupant load.

Take 10 minutes to read Subsection 3.14.1., then answer the following questions. Provide ode references with answers where applicable.

EXERCISE #15-1

1. Tents having an area greater than 225 m^2 are required to conform to which of the following requirements?

   a) means of egress ____________
   b) clearance to other structures ____________
   c) flame resistance ____________
   d) provision for firefighting ____________

2. How close can a tent be located to a building, other tents or a property line?

   ____

   ____

   ______________________ [__________]

   ______________________ [__________]

   Are there any exceptions to the 3 m clearance in Question #2?

   ____

   ____

   ______________________ [__________]

3. What flammability standard is a tent fabric required to be tested to?

____

____

____

______________________________ [______________]

STOP

15.4 AIR-SUPPORTED STRUCTURES (Subsection 3.14.2.)

The occupancy and location of air-supported structures are dealt with in Articles 3.14.2.2., 3.14.2.3. and 3.14.2.4.

Figures 15-1and 15-2 illustrate the difference between the requirements of Sentences 3.14.2.3.(3) and 3.14.2.3.(4).

Take 15 minutes to read Subsection 3.14.2. and complete Exercise #15-2.

EXERCISE #15-2

1. The owner of an industrial building intends to install an air-supported structure for the purpose of storing highly hazardous materials. The structure will be connected to the building by a walkway. Is this permitted?

____

______________________________[______________]

2. An air-supported structure may be attached to another building where the building:

   a) consists of a maximum area of 200 m^2
   b) is sprinklered or is separated from the air-supported structure by a fire separation having a 1 h fire-resistance rating
   c) conforms to the requirements of other Parts of the Code based on the building area of the building.
   d) has all of the above.

____

______________________________[______________]

3. When is an emergency air supply required for an air-supported structure?

____

____

______________________________[______________]

4. Are air-supported structures permitted to have a mezzanine constructed as part of the intended occupancy?

____

____

____

______________________________ [______________]

STOP

Sentence 3.14.2.3.(3)

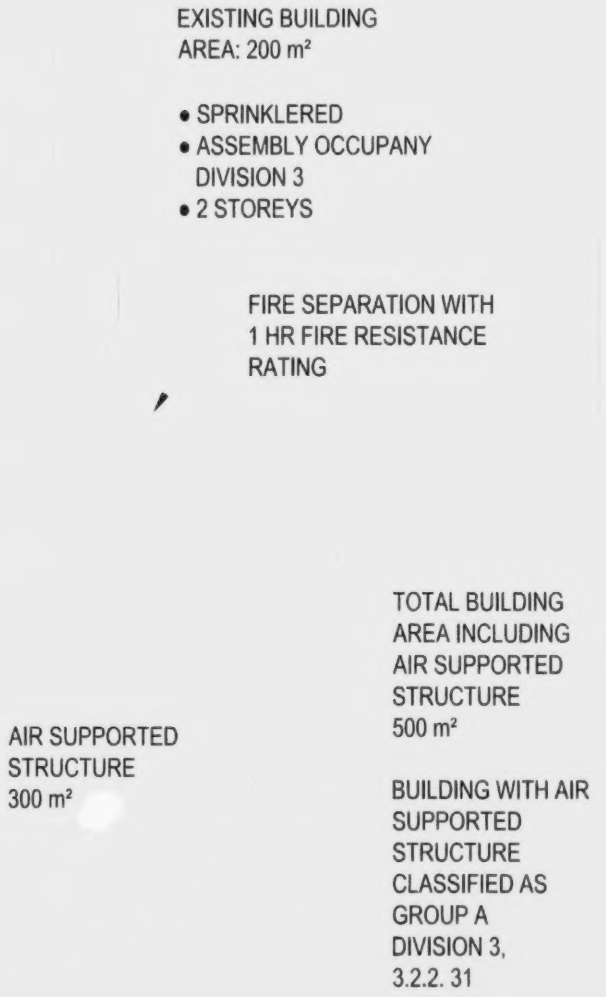
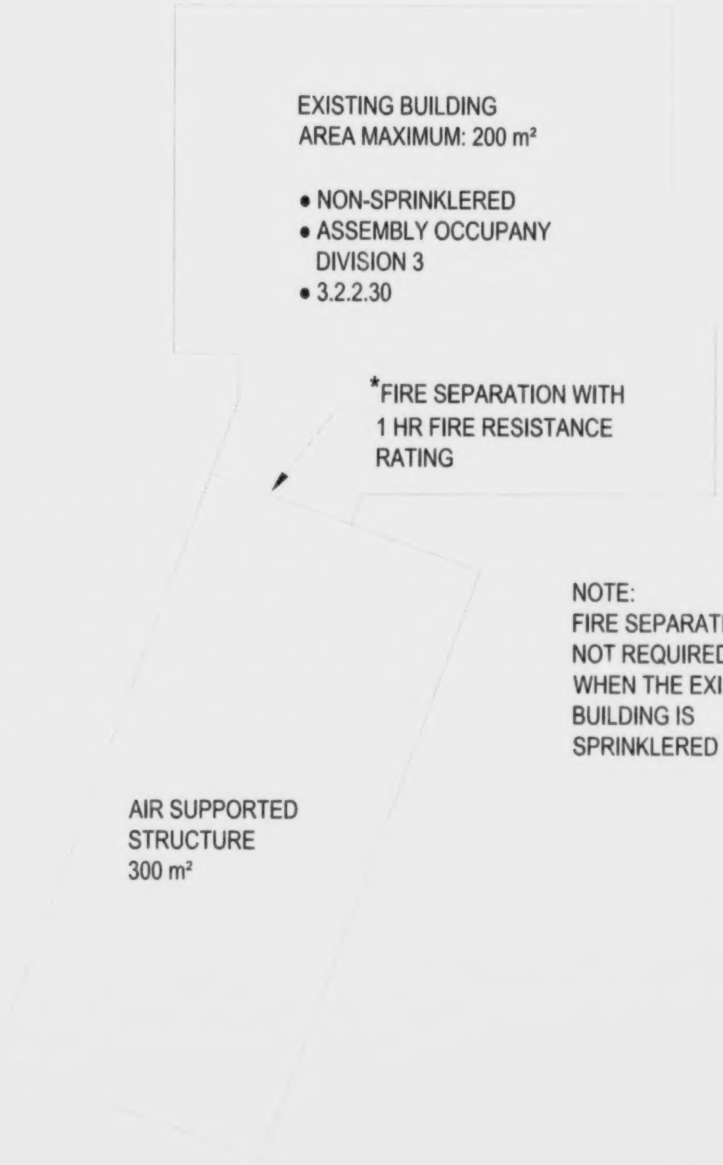

EXISTING BUILDING
AREA: 200 m²
• SPRINKLERED
• ASSEMBLY OCCUPANY DIVISION 3
• 2 STOREYS
FIRE SEPARATION WITH 1 HR FIRE RESISTANCE RATING
TOTAL BUILDING AREA INCLUDING AIR SUPPORTED STRUCTURE 500 m²
AIR SUPPORTED STRUCTURE 300 m²
BUILDING WITH AIR SUPPORTED STRUCTURE CLASSIFIED AS GROUP A DIVISION 3, 3.2.2. 31

FIGURE 15-1

Sentence 3.14.2.3.(4)


EXISTING BUILDING
AREA MAXIMUM: 200 m²
• NON-SPRINKLERED
• ASSEMBLY OCCUPANY DIVISION 3
• 3.2.2.30
*FIRE SEPARATION WITH 1 HR FIRE RESISTANCE RATING
AIR SUPPORTED STRUCTURE 300 m²

NOTE:
FIRE SEPARATION IS NOT REQUIRED WHEN THE EXISTING BUILDING IS SPRINKLERED

FIGURE 15-2

PART B

15.5 SIGNS (Section 3.15)

Signs are regulated by Subsections 3.15.1., 3.15.2., 3.15.3., 3.15.4., and 3.15.5. of the Code.

Take 15 minutes to read the above Subsections and complete Exercise #15-3.

EXERCISE #15-3

1. Most signs are required to be designed in accordance with Part 4. True or false?

   ______________________________[________________]

2. A non-metallic sign having a plastic face is located on the exterior wall of a building. The exterior wall is of noncombustible construction. The sign is approximately 40% of the building wall area and projects 600 mm over a public sidewalk. The sign is located 2395 mm above the sidewalk.

   Is the sign permitted in such a location? Yes or no, and explain why.

   ____

   ____

   ______________________________[________________]

3. Is a sign painted directly on a building subject to the provisions of Section 3.15.?

____

_______________________________ [_______________]

4. What type of sign is permitted to obstruct a means of egress or required access for firefighting?

____

_______________________________ [_______________]

5. What is the permitted maximum average burn rate of 1.5 mm thick plastic, used in the construction of a sign face when tested in a horizontal position, and to what standard is the plastic tested?

____

____

_______________________________ [_______________]

STOP

PART C

15.6 APPLICATION (Section 3.16)

Shelf and rack storage systems shall be designed and constructed in accordance with Section 3.16 of the Code.

Separate sets of requirements are provided for:

- storage of Class I, II, III and IV commodities as defined in NFPA 13, "Installation of Sprinkler Systems", and
- storage of Class A, B, and C plastics and rubber tires as defined in NFPA 13, "Installation of Sprinkler Systems".

Shelf and rack storage systems may be designed for storage, accessing, retrieval, packing and distribution of commodities.

Shelf and rack storage systems are not permitted to be designed for production, manufacturing, assembling, disassembling or ancillary administrative function, nor can they be installed in a high hazard occupancy [3.16.1.2.(1), (2) and (3)].

15.7 OVERVIEW (Section 3.16)

Shelf and rack storage systems shall not exceed 24 m in height, except if intended for storage of Group A, B, and C plastics and rubber tires, which are limited to 7 m in height [3.16.1.2.(4) and 3.16.3.2.(1) and (3)].

Structural components of a shelf and rack storage system, including posts, beams, decks, walkways, connections and their supports, such as concrete slabs and foundations, shall be designed in accordance with Division B, Part 4 [3.16.1.3.(1)].

In every floor area containing a shelf and rack storage system, an automatic sprinkler system designed, constructed, installed and tested in conformance with NFPA 13, "Installation of Sprinkler Systems", shall provide protection under all platforms and walkways [3.16.1.6.(1) and (2)].

The automatic sprinkler system shall be:

- electrically supervised [3.16.1.6.(5)],
- designed to notify the fire department [3.16.1.6.(6)], and
- a fire alarm system to notify the person controlling the building [3.16.1.6.(7)].

15.8 EXITS AND MEANS OF EGRESS

Every walkway or platform level shall be provided with a minimum of two exits conforming to Section 3.4 except as follows [3.16.1.7.(1)]:

a) An elevated platform level may be provided with an access to exit by open, unenclosed stairs serving:

  - no more than four platform levels, the highest of which shall be no more than 12 m above the main floor, where the shelf and rack storage system is intended for the storage of Class I, II, III, and IV commodities as defined in NFPA 13, and

  - not more than two platform levels, where the shelf and rack storage system is intended for the storage of Group A, B, and C plastics and rubber tires, as defined in NFPA 13 [3.16.1.7.(2)].

b) A single platform or walkway may be served by a single unenclosed stair leading to the platform or walkway level immediately below provided:

  - the platform or walkway does not exceed 200 m^2,
  - the travel distance on the platform or walkway below, including the travel distance along unenclosed egress stairs, does not exceed 25 m, and
  - the platform or walkway below is provided with two separate egress stairs or exits [3.16.1.7.(3)].

The maximum travel distance on an elevated platform shall not exceed 45 m:

- to the exit serving that platform,
- including the travel distance along an unenclosed stair to the ground floor level [3.16.1.7.(4)].

The maximum travel distance:

- along a main aisle on the ground level from the bottom of an unenclosed stair to an exit serving ground level shall not exceed 45 m [3.16.1.7.(6)], or
- an egress serving shelf and rack storage systems shall be designed on the basis of a time-based egress analysis [3.16.1.7.(7)].

The time-based analysis shall be based on the following criteria where the maximum travel distance exceeds 45 metres, provided that the occupant load on each level of the shelf and rack storage system does not exceed 10 persons per egress stair [3.16.1.7.(7)(g)]:

i. occupant egress speed of 1 m/sec shall be used for horizontal egress routes within the shelf and rack storage system [3.16.1.7.(7)(a)(i)],
ii. occupant egress speed of 0.6 m/sec shall be used for vertical egress routes within the shelf and rack storage system, measured on the diagonal along the nosing of the stairs [3.16.1.7.(7)(a)(ii)],
iii. occupant egress speed of 1.3 m/sec shall be used for horizontal egress routes along the main aisle on the ground floor [3.16.1.7.(7)(a)(iii)],
iv. each lift-gate shall be accorded an egress time of 10 seconds [3.16.1.7.(7)(a)(iv)],
v. each at-level conveyor crossover shall be accorded a time of 5 seconds [3.16.1.7.(7)(a)(v)],
vi. a safety factor of 1.5 shall be used in calculating the total egress time [3.16.1.7.(7)(a)(vi)].

The total egress time shall be calculated using the following formula:

Total Egress time = $(H_p+V_p/0.6+H_m/1.3+10N_{lg}+5N_{lc}) \times 1.5$ [3.16.1.7.(7)(b)]

Where:

H_p	horizontal travel distance on the shelf and rack system in metres
V_p	vertical travel distance on the shelf and rack system in metres
H_m	horizontal travel distance on the main floor in metres
N_{lg}	number of lift-gates in the means of egress,
N_{lc}	number of at-level crossover in the means of egress.

Other conditions such as total egress time, fire alarm and detection systems, smoke detectors and pull stations, must also be considered and provided [3.16.1.7.(7)(c), (d), (e) and (f)].

EXERCISE #15-4

1. What is the maximum travel distance on an elevated platform including unenclosed stairs?

____

______________________________ [______________]

2. What is the maximum height of a shelf and rack storage system used to store rubber tires?

____

______________________________ [______________]

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 16

LARGE BUILDINGS - 2006

ADDITIONAL REQUIREMENTS FOR CHANGE OF USE AND RENOVATIONS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

16.1 INTRODUCTION (Section 3.17)

Additional requirements for change of use applies where proposed construction in respect of an existing building will result in the changes in use of all or part of the building.

Objectives

Once you have completed this module, you will be able to:

- demonstrate the ability to find, understand and apply the Code requirements related to Sections 3.17 and 11.5.
- demonstrate comprehension of applicable Code requirements through the use of 'exercises'.
- identify the respective Code requirements, and where required, identify the Code references and demonstrate the procedure/method of obtaining your answer.
- learn where the relevant sections are located in the Code to gain a better understanding of change of use and renovation.

Reference applicable standards.

STOP

16.2 OVERVIEW

Read to next STOP sign.

Definitions

The definitions below relate to the content in this module and are from Division A, Part 1 of the Code. Definitions form an integral part of a requirement when the requirement includes a defined term. Defined terms are found in the Code and are identified in italics text. While shown in italics in this section, defined terms will not be italicized throughout the remainder of this module.

Building System
Building system means a combination of elements or components that form a complete major division of construction in the design of a building or part of a building, including a structural or framing system, a waterproofing system, a drainage system, an exterior cladding system, a roofing system, a window system, a partition system, a corridor system, a stair system, a fire alarm and detection system, a sprinkler system or a heating, ventilation or air conditioning system, a foundation system, a standpipe and hose system, a flooring system, a plumbing system, a sewage system or an electrical system.

Compliance alternative
Compliance alternative means a substitute for a requirement in another Part of Division B that is listed in Parts 10 or 11 of Division B, and "C.A." has a corresponding meaning.

Construct
Construct means to do anything in the erection, installation, extension or material alteration or repair of a building and includes the installation of a building unit fabricated or moved from elsewhere and "construction" has a corresponding meaning (construire, construction, travaux de construction).

Construction index

Construction index means a level on a scale of 1 to 8 determined in accordance with Table 11.2.1.1.A. of Division B designating the expected performance level of the building structure with respect to the type of construction and fire protection of an existing building, and "C.I." has the corresponding meaning.

Farm Building

Farm building means a building or part thereof which does not contain a residential occupancy and which is associated with and located on land devoted to the practice of farming and used essentially for the housing of equipment or livestock, or the production, storage or processing of agricultural and horticultural produce or feeds.

Heritage building

Heritage building means a building designated under the Ontario Heritage Act, or a building that is certified to be of significant architectural or historical value by a recognized, non-profit public organization whose primary object is the preservation of structures of architectural or historical significance and which certification is accepted by the chief building official.

Major occupancy

Major occupancy means the principal occupancy for which a building or part thereof is used or intended to be used, and shall be deemed to include the subsidiary occupancies which are an integral part of the principal occupancy.

Performance level

Performance level means that level of performance under which all or part of an existing building functions with respect to its building systems.

Exit

Exit means that part of a means of egress, including doorways, that leads from the floor area it serves to a separate building, an open public thoroughfare or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare.

Means of egress

Means of egress includes exits and access to exits and means to a continuous path of travel provided for the escape of persons from any point in a building or in a contained open space to:

- a separate building,
- an open public thoroughfare, or
- an exterior open space that is protected from fire exposure from the building and that has access to an open public thoroughfare.

STOP

16.3 APPLICATION (Subsection 3.17.1.)

Additional requirements for change of use applies where proposed construction in respect of an existing building will result in the following changes in use of all or part of the building:

- A change in the major occupancy as per Table 1.3.1.4 of Division C.
- A Group C major occupancy is converted into more than one suite of Group C major occupancy.
- A farm building is changed to a major occupancy.
- The use of a building is changed and the previous major occupancy cannot be determined.
- A Group A, Division 2 or a Group A, Division 4 major occupancy is converted to a gaming premise.
- A building or part thereof is changed to a post-disaster building.
- For this section and 11.4.2.1.(1) [3.17.1.1.(1)].

The requirements of this section are in addition to the requirements of other Parts of the Code as they apply to the proposed construction [3.17.1.1.(3)].

16.4 CHANGE OF USE AND COMPENSATING CONSTRUCTION

Where the proposed construction will result in a change of the use described in clauses 3.17.1.1.(1) (a) to (d) additional construction shall be required in order that the building or part of the building subject to the change of use conforms to the requirements of Subsections 3.2.6. and Sections 3.7, 3.11. and 3.12 [3.17.2.1.(1)].

16.5 PERFORMANCE LEVEL AND COMPENSATING CONSTRUCTION

The performance level of a building after construction shall not be less than the performance level of the building prior to construction [3.17.2.2.(1)].

Articles 11.4.2.1., 11.4.2.3. and 11.4.2.5. determine reductions in performance levels [3.17.2.2.(2)].

If performance levels are reduced, compensating construction must be provided as required by Articles 11.4.3.1., 11.4.3.2., 11.4.3.4. and 11.4.3.6. [3.17.2.2.(3)].

Compliance alternatives may be used subject to all the requirements and conditions found in Section 11.5 for areas described in Sentences 11.4.3.4.(1), (3) and (4) [3.17.2.2.(4)].

STOP

EXERCISE #16-1

Take 15 minutes to read Subsections 3.17.1. and 3.17.2. and answer the following questions.

1. From the information in Table 1.3.1.4., Part 1, Division C, is a permit required if the major occupancy of a building is changed from a residential occupancy to a mercantile occupancy?

   ____

   ____________________________ [________________]

2. If a farm building is changed to an industrial occupancy, is a building permit required?

   ____

   ____________________________ [________________]

3. Consider a residential building which is being converted into an office building. Do the requirements in the Code for a Group D occupancy apply to the washroom facilities in the renovated building?

   ____

   ____________________________ [________________]

4. The performance level after construction shall:

   a) be less than the performance level of the building prior to construction

   b) not be less than the performance level of the building prior to construction

   c) not have a construction index more than prior to construction

   d) shall be equal to the performance level of the building prior to construction.

   ____

   ____________________________[________________]

5. What Articles and Sentences describe the factors that determine a reduction in performance level?

   ____

   ____________________________[________________]

STOP

16.6 COMPLIANCE ALTERNATIVES (Section 11.5)

Compliance alternatives shown in Tables 11.5.1.1.A, 11.5.1.1.B, 11.5.1.1.C, 11.5.1.1.D/E and 11.5.1.1.F, may be substituted for a requirement contained in Parts 3, 4, 5, 6, 7 or 8, of Div. B where the Chief Building Official is satisfied that compliance with the requirement is impracticable because of structural or construction difficulties, or that it is detrimental to the preservation of a heritage building [3.17.2.2.(4), 11.5.1.1.(1)].

Compliance alternatives shown in Tables 11.5.1.1.A, 11.5.1.1.B, 11.5.1.1.C, 11.5.1.1.D/E and 11.5.1.1.F, may be substituted for a requirement contained in Part 9, without satisfying the chief building official that compliance with the requirement is impracticable [11.5.1.1.(1)].

The Tables in Article 11.5.1.1. are divided into groups by the occupancy of the building, Group D business and personal services and Group E mercantile are grouped together.

Each Table has three columns. The first column is the column number, the second is the Code requirement, and column three is the Part 11 compliance alternative.

STOP

EXERCISE #16-2

Take 10 minutes to read Subsection 11.5.1. and answer the following questions.

1. What is a Part 11 Compliance Alternative for Article 3.2.4.21. which states that all smoke alarms are to be hard wired in a residential occupancy?

   ______________________________[______________]

2. In which Part of the Code may a compliance alternative be substituted for a Code requirement without having to satisfy the chief building official?

   ______________________________[______________]

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 17

LARGE BUILDINGS - 2006

PART 5

ENVIRONMENTAL SEPARATION

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

17.1 INTRODUCTION

Ontario Building Code - Part 5

Part 5 applies to all buildings except those within the scope of Part 9 or the scope of the National Farm Building Code of Canada [Div. A, 1.1.2.2.(1), 1.1.2.2.(4), 1.3.1.2 and Div. B, 5.1.1.1.(1)].

Objectives

After completing this module, participants will be able to:

- identify requirements governing heat transfer, air leakage, vapour diffusion, protection from precipitation, surface water and moisture in the ground.
- locate Code references to 'referenced standards' pertaining to wind, water and vapour protection.

17.2 OVERVIEW

The following terms from the Building Code, Division A, Article 1.4.1.2., used in this module, are defined. The definitions provided below are for information purposes only. Reference should be made to the respective definition in the official volume of the Code. While the definitions below appear in italics, as in the Code, they will not be italicized throughout the remainder of this module.

Air barrier system
Air barrier system means the assembly installed to provide a continuous barrier to the movement of air.

Conditioned space
Conditioned space means any space within a building the temperature of which is controlled to limit variation in response to the exterior ambient temperature or interior differential temperatures by the provision, either directly or indirectly, of heating or cooling over substantial portions of the year.

Foundation
Foundation means a system or arrangement of foundation units through which the loads from a building are transferred to supporting soil or rock.

Soil
Soil means, except for the purposes of Part 8 of Division B, a portion of the earth's crust that is fragmentary or such that individual particles of a dried sample may be readily separated by agitation in water; and includes boulders, cobbles, gravel, sand, silt, clay and organic matter.

Vapour barrier
Vapour barrier means the elements installed to control the diffusion of water vapour.

17.3 APPLICATION

Part 5 regulates the separation of environmentally dissimilar spaces. Most obvious is the need to separate indoor conditioned spaces from unconditioned spaces, the outdoors or the ground. There are also cases where separation is needed between interior spaces which are intended to provide different environments. This part also applies to site conditions that may affect moisture loading on building elements that separate interior space from exterior space and the ground [5.1.2.1.(1)].

The requirements address:

- The design and construction, or selection of building components such as windows and doors.
- The design and construction of building assemblies, such as walls, floors and roofs.
- The design and construction of the interfaces of the components in assemblies noted above.
- The design or selection, and installation of site elements such as backfill, grading and drainage.

An extreme example of the separation of significantly different interior environments would be a wall that separates an indoor ice rink from an indoor swimming pool [5.1.2.1.(1)].

Part 5 provides explicit requirements for controlling the transfer of heat, air and moisture in various forms, including water leakage and ground water. Requirements for radon and other soil gases are included with those related to air leakage.

17.4 ENVIRONMENTAL SEPARATION REQUIREMENTS
(Subsection 5.1.4.)

Environmental loads to be considered include, but are not limited to:

- ultraviolet radiation
- temperature (summer and winter)
- snow
- rain
- moisture
- air pressure
- acids and alkalis.

Mechanisms of deterioration include:

- structural (impact, air pressure)
- hygrothermal (freeze-thaw, differential movement due to thermal expansion and contraction, ice lensing)
- electrochemical (oxidation, electrolytic action, galvanic action, solar deterioration)
- biochemical (biological attack, intrusion by insects and rodents).

Resistance to deterioration is determined based on field performance, accelerated testing or guidelines by evaluation agencies recognized by the chief building official.

Materials that comprise building components and assemblies that separate dissimilar environments must be compatible with adjoining materials and resistant to any mechanisms of deterioration, except where incompatibility or uncontrolled deterioration will not adversely affect [5.1.4.2.(1)]:

a) health or safety of occupants
b) intended use of building, or
c) operation of building services [5.1.4.2.(2)]

Part 5 objectives related to occupant health in the indoor environment that might not be achieved if the requirements of the Code are not met:

- Accumulated moisture may support mould and mildew growth. This can contribute to poor indoor air quality from airborne spores and bacteria, which can cause illness. Material degradation may also occur, including damage to finishes or the building structure.
- Infiltration can amplify the effects of mould and mildew on indoor air where the deterioration is within the environmental separator. It can also bring additional problems from soil gases such as radon and methane and from outdoor air pollutants such as exhaust fumes from vehicles.
- Infiltration can also produce unacceptable thermal conditions if it leads to cold drafts in the occupant space.

Part 5 objectives related to safety that are intended to minimize the harm that might result from hazards such as:

- ice or snow falling from roofs
- materials falling from the building due to failure of fastening devices that is caused by corrosion
- freezing of critical services such as fire suppression sprinkler piping, caused by infiltration of cold air
- degradation of structural strength due to rotting or rusting caused by the presence of water trapped within an assembly.

Other Requirements (5.1.5.)

Acoustical, structural and fire safety requirements must comply with other Parts of the Code [5.1.5.1.(1)].

Exterior and Interior Environment Loads (5.2.1.)

- climactic loads based on Supplementary Standard SB-1 [5.2.1.1.(1)]
- below ground loads based on Supplementary Standard SB-1 or by geological and hydrological data or site tests [5.2.1.1.(2)]
- interior loads based on intended use of the space [5.2.1.2.(1)].

Calculations (5.2.2.1.)

Heat, air and moisture transfer calculations are to conform to good engineering practice such as described in ASHRAE Fundamentals Handbook [5.2.1.3.(1)].

Soil temperatures are to be based on average soil temperature, seasonal amplitude of variation and attenuation of variation within depth [5.2.1.3.(2)].

STOP

EXERCISE #17-1

1. In Section 5.2, how are interior environmental loads derived?

____

____________________________ [______________]

2. To what Subsection of the Code shall wind load calculations conform?

____

____________________________ [______________]

STOP

Heat Transfer (5.3)

Heat transfer is addressed in Subsection 5.3.1.

Building components or assemblies subject to intended temperature differentials must include materials to resist heat transfer. This does not apply where it can be shown that uncontrolled heat transfer will not adversely affect [5.3.1.1.(1) and (2)]:

a) health or safety of building users
b) intended use of buildings, or
c) operation of building services.

Materials and components installed to resist heat transfer must provide sufficient resistance for the interior and exterior design temperatures to:

a) minimize surface condensation on the warm side of the component or assembly,
b) minimize condensation within the component or assembly,
c) maintain the interior design thermal conditions for the intended occupancy,
d) minimize ice damming on sloped roofs, and
e) take into account conditions on both sides of the environmental separator [5.3.1.2.(1)].

Total prevention of condensation is generally unnecessary and its achievement is rarely a certainty at design conditions. Part 5 therefore requires that condensation be controlled to minimize material deterioration and the growth of mould and fungi. Surface condensation may occur on different surfaces depending on the season of the year.

Materials and components must meet the requirements of standards referred to in Part 5 to minimize condensation and to ensure thermal conditions appropriate for building use. Energy conservation standards and codes specify levels of thermal resistance for energy efficiency or refer to energy performance levels, which relate to levels of thermal resistance. Where Part 5 calls for levels of thermal resistance higher than those required by the energy regulations, the requirements of Part 5 take precedence.

Metal framed windows separating interior conditioned space from interior unconditioned space or exterior space must incorporate a thermal break to minimize condensation [5.3.1.2.(2)].

Where materials are penetrated or are interrupted by expansion, control or construction joints, materials must be positioned to minimize condensation at these locations [5.3.1.3.(1)].

Materials must have sufficient inherent resistance to air flow or be positioned in the assembly to prevent convection air flow through and around the material [5.3.1.3.(2)].

STOP

EXERCISE #17-2

1. Refer to Article 5.3.1.2. and list the types of windows and doors that are exempt from the requirement for thermal break. Give Code reference.

   ____

   ______________________________[______________]

2. Refer to Section 5.10. To what CAN/CGSB Standard shall "Thermal Insulation, Phenolic, Faced" conform when installed to provide the required resistance to heat transfer? Give Code reference.

   ____

   ______________________________[______________]

STOP

Air Leakage (Section 5.4)

Air barrier systems are addressed in Subsection 5.4.1.

In general, an environmental separator is required to have an air barrier system. Air barrier system means the membrane is installed to provide a continuous barrier to the movement of air.

Air barrier systems in above grade building components and assemblies separating conditioned space from the exterior will reduce the likelihood of condensation to air leakage, discomfort from drafts, infiltration of dusts and other pollutants, and interference in the performance of building services such as HVAC and plumbing.

Sheet and panel type materials providing the principal resistance to air leakage must have an air leakage characteristic not greater than 0.02 $L/(s \bullet m^2)$ measured at an air pressure difference of 75 Pa [5.4.1.2.(1)].

An air barrier system is not required where it can be shown that uncontrolled air leakage will not adversely affect:

a) health or safety of building users
b) intended use of building, or
c) operation of building services [5.4.1.1.(3)].

An air barrier system must be continuous:

a) across construction, control and expansion joints,
b) across junctions between different building assemblies, and
c) around penetrations through the building assembly [5.4.1.2.(3)].

Wind load must be considered in the design and construction of building assemblies having an air barrier system [5.4.1.2.(4)].

STOP

EXERCISE #17-3

1. What is the purpose of an air barrier system? Give Code reference.

   a) limit the spread of smoke
   b) resist heat transfer
   c) provide the principal resistance to air leakage, or
   d) minimize moisture transfer

   ____________________[______________]

2. What is the maximum permitted air leakage characteristic of a material used as an air barrier?

   ____________________[______________]

STOP

Vapour Diffusion (Section 5.5)

Vapour barriers are addressed in Subsection 5.5.1.

Building components subject to temperature differential and differential in water vapour pressure must include a vapour barrier unless it can be shown that uncontrolled vapour diffusion will not adversely affect:

a) health or safety of building users
b) intended use of the building, or
c) operation of building services[5.5.1.1.(3)].

A vapour barrier must have a sufficiently low permeance and be positioned in a building component or assembly so as to:

a) minimize moisture transfer to surfaces within the assembly that would be cold enough to cause condensation at the design temperature and humidity conditions [5.5.1.2.(1)(a)], or
b) reduce moisture transfer to limit the accumulation of moisture within the assembly to minimize deterioration of the assembly [5.5.1.2.(1)(b)].

Section 5.10 includes a list of Standards for materials installed to provide the required resistance to vapour diffusion.

Sentences 5.5.1.2.(2) and (3) include a list of standards related to coatings applied to gypsum wallboards and other materials to provide required resistance to vapour diffusion.

STOP

EXERCISE #17-4

1. Where is a vapour barrier required in a building component or assembly?

____

___________________________ [_______________]

2. For what purpose is the Standard ASTM E96 used?

____

___________________________ [_______________]

STOP

Protection from Precipitation [Section 5.6]

Subsections 5.6.1. and 5.6.2. address protection from precipitation.

Building components or assemblies exposed to precipitation must:

a) minimize entry of precipitation into the component or assembly, and
b) prevent entry of precipitation into interior space [5.6.1.1.(1)].

Protection from entry of precipitation is not required where it can be shown that such entry will not adversely affect:

a) health or safety of building users
b) intended use of building, or
c) operation of building services [5.6.1.1.(2)].

Section 5.10 includes a list of standards for protective materials and components.

Materials, components, assemblies, joints and materials, junctions between components and junctions between assemblies exposed to precipitation must be:

- sealed to prevent entry of precipitation, or
- drained to direct precipitation to the exterior [5.6.2.1.(1)].

Where water, snow or ice can accumulate on a building, provisions must be made to minimize the likelihood of hazardous conditions arising from such accumulations [5.6.2.2.(1)].

Provisions for drainage in conformance with Section 7.4 must be made where rain or snow can accumulate on sloped or horizontal assemblies [5.6.2.2.(2)].

Where down spouts are provided and not connected to a sewer, provisions must be made to:

a) divert the water from the building, and
b) prevent soil erosion [5.6.2.2.(3)].

STOP

EXERCISE #17-5

1. In Article 5.6.1.1., what are the basic requirements for a building component or assembly exposed to precipitation?

____

______________________________[______________]

2. What standard applies to the installation of an asphalt shingle roof with a slope 1:6 to less than 1:3?

____

______________________________[______________]

STOP

Surface Water (Section 5.7)

Subsection 5.7.1. addresses protection from surface water.

The following must be considered in the design and construction so that water will not accumulate or enter into the building or damage moisture-susceptible materials.

- the building location
- site grading
- catch basin installation
- foundation wall construction.

Buildings are exempt from the above where they have been specifically designed to accommodate accumulation of water at the building or water entry [5.7.1.1.(3)].

Ground Moisture (Section 5.8)

Subsection 5.8.1. addresses foundation and floor drainage.

A wall or floor located below the water table or in the path of a water course will be subjected to continuous hydrostatic pressure. In such cases, drainage will be ineffective and the wall or floor must be made waterproof to prevent water entry [5.8.1.1.(1)].

The bottom of every exterior foundation wall and every floor on ground must be provided with drainage unless the wall or floor is subject to continuous hydrostatic pressure or drainage can be shown to be unnecessary [5.8.1.1.(1)].

Drainage must be designed and installed to accommodate the drainage load [5.8.1.2.(1)].

Building elements must be installed to prevent the transfer of moisture from the ground to interior space [5.8.2.1.(1)].

Materials installed to provide required moisture protection must be capable of bridging:

a) construction, control and expansion joints
b) junctions between different building materials, and
c) junction between building materials and elements penetrating building assemblies [5.8.2.2.(2)].

Alternatively, control and expansion joints must be designed to maintain the continuity of moisture protection, where the moisture protection material is not capable of bridging construction [5.8.2.2.(3)].

Moisture protection materials and components must have sufficiently low water permeance to resist moisture loads [5.8.2.2.(4)].

Moisture protection must be designed and constructed to resist hydrostatic pressures as determined in accordance with Section 4.2[5.8.2.2.(5)].

Article 5.8.2.3. includes a list of standards for materials that may resist the transfer of moisture.

Crawl spaces may be used as warm air plenums if design measures are taken to prevent moisture, soil or radon gases from entering the crawl space and being distributed throughout the space [Appendix note A-6].

Waterproofing

In general, Part 5 requires walls, floors and roofs in contact with the ground to be waterproofed. Properties of waterproofing are specified in Sentences 5.8.2.2.(2) to (5). Materials intended to be used as damp proofing rather than waterproofing are generally not permitted [Sentence 5.8.2.2.(7)]. Standards for installing waterproofing are also specified [Sentence 5.8.2.3.(1)].

Part 5 does permit the use of damp proofing in lieu of waterproofing where the substrate is cast-in-place concrete, a drainage layer is installed and where the assembly will not be exposed to hydrostatic pressure [5.8.2.2.(7)].

If damp proofing is provided, the drainage system needs to be designed to control the hydrostatic pressure.

STOP

EXERCISE #17-6

In Section 5.8, under what circumstance is it not necessary to install materials that prevent moisture transfer from the ground to interior space?

____

____

____

______________________ [__________]

STOP

Sound Transmission (Section 5.9)

Article 5.9.1.1. lists the standard used to determine sound transmission class ratings (STC) and the test measuring techniques.

The requirements for sound transmission class ratings only apply to the sound separation of dwelling units from every other space in a building (Sentence 5.9.1.2.(1)) and between dwelling units and elevator hoistways or refuse chutes (Sentence 5.9.1.2.(2)).

The construction used to separate dwelling units from other parts of the building shall provide an STC of at least 50.

The construction used to separate dwelling units from elevator hoistways or refuse chutes shall provide an STC of at least 55.

STOP

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY MANUAL

MODULE 18

LARGE BUILDINGS - 2006

STRUCTURAL DESIGN

HEAT, VENTILATING AND AIR CONDITIONING

PLUMBING

HOUSING AND SMALL BUILDINGS

RESOURCE CONSERVATION

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

MODULE 18 STRUCTURAL DESIGN
HEATING, VENTILATING AND AIR CONDITIONING
PLUMBING
HOUSING AND SMALL BUILDINGS
RESOURCE CONSERVATION

18.1 INTRODUCTION

Even though the majority of the Large Building course is dedicated to requirements found in Division B, Part 3, a number of additional requirements related to fire protection, health and safety objectives are found in other parts of Division B of the Code.

This module will cover requirements found in the following additional parts of Division B:

Part 4 - Structural Design
Part 6 - Heating, Ventilating and Air Conditioning
Part 7 - Plumbing
Part 9 - Housing and Small Buildings
Part 12 - Resource Conservation

In addition, materials in Supplementary Standards SB-1 and SB-10, which are referred to in the above parts of the Code, will be addressed in this module.

Objectives

Upon completion of this module you will be able to:

- Provide an understanding of the loading requirements for guards.
- Provide an understanding of the requirements for fireplaces, materials in air duct systems, ducts, duct coverings, linings and insulation materials used in duct systems and return air plenums, clearances between combustible materials and pipes carrying steam or hot water, carbon monoxide alarms and chimneys.

- Provide an understanding of requirements of the Code relating to plumbing facilities, including location of plumbing fixtures, and water temperature control for potable water systems.
- Understand and apply the provisions of the Code relating to measurement of floor areas for dwelling units, ceiling heights, and living areas within dwelling units.
- Understand and apply the provisions of the Code related to doors to bathrooms, glass in doors and sidelights, minimum window and glass areas for rooms in buildings of residential occupancy, the design and construction of interior and exterior stairs, steps, ramps, railings and guards, and lighting outlets.
- Provide an understanding of the requirements of the Code relating to resource conservation in the design and construction of buildings, including energy efficiency design, and energy efficiency design requirements for which a building permit has been applied for after December 31, 2011, motion sensors, and water efficiency.
- Reference applicable standards.

18.2 STRUCTURAL DESIGN (Subsection 4.1.5.)

In addition to the requirements for loads on handrails which are covered in Division B, Sentence 3.4.6.4.(9), Article 4.1.5.15. prescribes the design requirements for guards based on their minimum specified horizontal load, applied either inward or outward at the top of every required guard for:

a) means of egress in grandstands, stadiums, bleachers and arenas,
b) equipment platforms contiguous stairs and other areas where the gathering of people is improbable, and
c) for all other locations of guards.

Individual elements within the guard such as solid panels and pickets must be designed to withstand a load of 0.5 kN applied over an area of 100 x 100 mm. The point located must be selected to produce the most critical effect on the guard [4.1.5.15.(2)].

The loads required for individual elements do not need to be considered to act simultaneously with the loads provided in Sentences (1) and (4) of Article 4.1.5.15. [4.1.5.15.(3)].

The minimum specified load applied vertically at the top of every required guard shall be 1.5 kN/m and does not need to be considered to act simultaneously with the load in Sentence (1) of Article 4.1.5.15. [4.1.5.15.(4)].

Walls Acting as Guards

Sentence 4.1.5.17.(1) indicates where floor elevation on one side of a wall is more than 600 mm higher than the elevation on the other side, the wall must be designed to resist lateral design loads prescribed in Section 4.1 ("Structural Loads and Procedures") or 0.5 kPa, whichever load produces the most critical effect.

18.3 DESIGN AND INSTALLATION OF HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS

Fireplaces (Article 6.2.1.5.)

According to Sentence 6.2.1.5.(1), fireplaces must conform to the requirements of Section 9.22.

Section 9.22 provides requirements for masonry fireplaces and includes provisions for the masonry and concrete used [9.22.1.2.], footings [9.22.1.3.], combustion air [9.22.1.4.], fireplace liners comprising fire brick or steel [Subsection 9.22.2.]; fireplace walls [Subsection 9.22.3.], the distance from the back of the fire chamber to the plane of the fireplace opening shall be not less than 300 mm [9.22.4.], design of the hearth [9.22.5.], the required dampers and size of damper [9.22.6.], the slope of the smoke chamber and wall thickness of the smoke chamber [9.22.7.].

Factory built fireplaces must conform to CAN/ULC-S610 "Factory Built Fireplaces" [9.22.8.]. Clearances to combustible materials are described for fireplaces in Sentences 9.22.9.1 (clearance to fireplace opening), 9.22.9.2 metal exposed to the interior, 9.22.9.3 clearances to combustible framing, and 9.22.9.4 heat circulating duct openings.

Fireplace inserts and hearth mounted stoves must be vented through the throat of a fireplace and conform to the Standard ULC-S628, "Fireplace Inserts". The installation of fireplace inserts and hearth mounted stoves vented through the throat of a fireplace shall conform to CAN/CSA-B365 "Installation Code for Solid Fuel Burning Appliances and Equipment" [9.22.10].

Materials in Air Duct Systems (Subsections 6.2.3. and 6.2.4.)

All ducts, duct connectors and associated fittings and plenums used in air duct systems must be constructed of steel, aluminum alloy, copper, clay, asbestos cement, or similar noncombustible material with the following exceptions [6.2.3.2.(1)]:

Ducts, their fittings and plenums may contain certain combustible materials provided [6.2.3.2.(2)]:

a) they meet requirements for Class 1 duct materials in CAN/ULC-S110-M, "Test for Air Ducts".

b) conform to Article 3.1.5.15. in a building required to be of noncombustible construction,
c) conform to Subsection 3.1.9.,
d) are used only in horizontal runs in buildings required to be noncombustible,
e) are not used in vertical runs serving more than two storeys in buildings required to be of noncombustible construction, and
f) are not used in air duct systems in which the air temperature may exceed 120°C.

Duct sealants are permitted provided they have a flame spread rating not more than 25 and a smoke developed classification of not more than 50 [6.2.3.2.(3)].

Duct connectors between ducts and air outlets may contain combustible materials provided [6.2.3.2.(4)] if:

a) they conform to requirements for Class 1 air duct materials in CAN/ULC-S110-M, "Tests for Air Ducts",
b) are limited to 4 m in length,
c) are used only in horizontal runs, and
d) do not penetrate required fire separations.

If the air duct materials are used in locations subject to excessive moisture, they shall show no appreciable loss of strength and must be corrosion resistant [6.2.3.2.(5)]. All ductwork and fittings shall be constructed and installed in accordance with SMACNA Manuals and ASHRAE Handbooks [6.2.3.2.(6)].

Requirements for duct lining covering adhesives and insulation are detailed in Article 6.2.3.4. These requirements include the use of noncombustible materials when exposed surface temperature is likely to exceed 120°C, limits on flame spread ratings and smoke developed ratings, requirements to comply with the Hot Surface Performance Test Standard ASTM-C411 for coverings and linings, restrictions on foamed plastics insulations used as part of an air duct system and requirements for terminating linings and coverings near heat surfaces and where ducts penetrate a fire separation.

Air ducts that are typically used for return air are referred to in the Code as 'low capacity systems'. These requirements are detailed in Subsection 6.2.4.

Piping for Heating and Cooling Systems (Subsection 6.2.9.)

Table 6.2.9.3. prescribes the clearance between steam or hot water pipes and combustible materials based on the temperature of the steam or water being carried through the pipes. Steam or hot water radiators cannot have an exposed surface temperature in excess of 70°C, unless precautions are taken to prevent human contact [6.2.9.4.(1)].

Carbon Monoxide Alarms (Subsection 6.2.12.)

Carbon monoxide alarms are required in every building that contains a residential occupancy, and that contains a fuel fired appliance or a storage garage [6.2.12.1.(1)].

Where fuel burning appliances are installed in a suite of residential occupancy, a carbon monoxide alarm must be installed adjacent to each sleeping area in the suite [6.2.12.2.(1)]. Where a fuel burning appliance is installed in a service room that is not in a suite of residential occupancy, a carbon monoxide alarm must be installed adjacent to each sleeping area in every suite of residential occupancy adjacent to the service room and in the service room [6.2.12.2.(2)].

Where a storage garage is located in a building containing a residential occupancy, a carbon monoxide alarm shall be installed adjacent to each sleeping area in every suite of residential occupancy that is adjacent to the storage garage [6.2.12.2.(3)].

The installation of carbon monoxide alarms is detailed in Article 6.2.12.3. Carbon monoxide alarms are required to be permanently connected to an electrical circuit with no disconnect switch, be wired so that their activation will activate all carbon monoxide alarms within the suite when located within a suite of residential occupancy, be equipped with an alarm audible within bedrooms when the intervening doors are closed if located in a suite of residential occupancy, and the alarms shall conform to either CAN/CSA-6.19 or UL2034.

Masonry/Concrete Chimneys (Subsection 6.3.1.)

Rectangular masonry or concrete chimneys not more than 12 m in height shall conform to Part 9 of the Code if they serve appliances with a combined total rated heat output of 120 kW or less, or fireplaces [6.3.1.2.(1)]. All other masonry or concrete chimneys shall be designed and installed in conformance with the requirements of NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances".

Where single wall metal smokestacks are used, they shall be designed and installed in accordance with NFPA 211, "Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances" [6.3.1.3.(1)].

Access ladders for chimneys, when provided, shall consist of steel or bronze rungs built into the walls of the chimneys. Rungs for external ladders shall begin at a distance not less than 2500 mm above ground level [6.3.1.5.(1) and (2)].

18.4 PLUMBING
(Sections 7.1 and 7.6)

Plumbing Facilities

According to Sentence 7.1.4.1.(1)., plumbing facilities shall be provided in accordance with Subsection 3.7.4. and Section 9.31.

The requirements from Subsection 3.7.4. have previously been covered in Module 10 of this course. The scope of Section 9.31 includes plumbing facilities and plumbing systems serving dwelling units, plumbing facilities, grab bars, floor drains and floor and wall finishes around urinals, for recreational camps, camps for housing workers or other buildings that are not dwelling units. Medical gas piping systems is also covered under Section 9.31 by reference to Subsection 3.7.5.

Article 7.1.4.2., Floor Drains, indicates:

1. Where gravity drainage is possible, a floor drain shall be installed in a basement forming part of the dwelling unit.

2. Where gravity drainage is not possible, the floor drain may be connected to a storm drainage system, dry well or drainage ditch provided it is located where it can receive only clear waste or storm sewage.

3. Floor drains shall be provided in public laundry rooms, garbage rooms, incinerator rooms, and boiler or heating rooms not within a dwelling unit.

Location of Fixtures

According to Sentence 7.1.6.1.(1), plumbing fixtures are not to be installed in a room that is not lighted and ventilated in accordance with requirements of Part 9 and Part 3. Every fixture, plumbing appliance, interceptor, cleanout, valve, device or piece of equipment shall be located such that it is readily accessible for use, cleaning and maintenance [7.1.6.2.(1)].

Water Temperature Control for Potable Water Systems

The maximum temperature of water supplied by fixtures in a residential occupancy shall not exceed 49°C. This requirement does not apply to hot water supplied to dish washers or clothes washers [7.6.5.1.(1) and (2)].

The requirements for valves supplying fixed location shower heads, as well as deck mounted or hand-held spray attachments, are located in Article 7.6.5.2.

For Group B, Division 2 or 3 occupancies, or for residents of a group home, home for special care, or residents for developmentally handicapped adults, are required to have one or more temperature gauges and control devices that are:

a) accessible only to supervisory staff, and
b) capable of being adjusted to ensure that the temperature of the water supplied to the fixture does not exceed 49°C. This applies to any bath tub, shower or hand basin that is accessible to residents of these types of facilities [7.6.5.3.(1)].

18.4 HOUSING AND SMALL BUILDINGS (PART 9 Requirements)

DESIGN OF AREAS AND SPACES (Section 9.5)

This section applies only to dwelling units that are intended for use on a continuing or year-round basis. General requirements for method of measuring areas and spaces, maximum floor areas, combination rooms and rooms with lesser dimensions than permitted in this section, are located in Subsection 9.5.1. [3.7.1.1.(2) and 3.7.1.2.(1)].

Ceiling Heights (Subsection 9.5.3.)

Minimum ceiling heights of rooms or spaces in residential occupancies, live/work units, mezzanines and storage garages are detailed in Articles 9.5.3.1., 9.5.3.2., and 9.5.3.3.

Living Rooms or Spaces within Dwelling Units (Subsection 9.5.4.)

According to Sentence (1) of Article 9.5.4.1., living areas within dwelling units, either separate rooms or in combination with other spaces, shall have an area not less than 13.5 m^2. Where the area of the living space is combined with a kitchen and dining area, the living area alone in the dwelling unit that can accommodate sleeping for not more than two persons, shall be not less than 11 m^2 [9.5.4.1.(2)].

DOORS (Section 9.6.)

Doors to Bathrooms

According to Article 9.6.3.3., where a barrier-free path of travel conforming to Section 3.8 is provided into a suite of residential occupancy, and where the bathroom within this suite is at the level of the suite entrance door, the doorway to the bathroom and to each bedroom at the same level as the bathroom, when the door is in the open position shall have a clear width of not less than 760 mm if the door is served by a corridor or space not less than 1060 mm wide and 810 mm where the door is served by a corridor space less than 1060 mm wide [9.6.3.3.(1)].

Glass in Doors and Sidelights

Glass in doors and sidelights for doors shall conform to Sentence 9.7.3.1.(1). If the glass in the sidelight is greater than 500 mm wide, such that it could be mistaken for doors, and glass in storm doors and sliding doors at an entrance to a dwelling unit and in public areas, the safety glass of:

a) the tempered or laminated type conforming to CAN/CGSB 12.1, "Tempered or Laminated Safety Glass" **OR**

b) wired glass conforming to CAN/CGSB 12.11 "Wired Safety Glass" [9.6.6.2.(2)].

If the glass in entrance doors to dwelling units in public areas exceeds 0.5 m^2 and extends to less than 900 mm from the bottom of the door, the glass shall be safety glass or wired glass as previously described [9.6.6.2.(3)].

Minimum Window Areas

The minimum window glass areas for rooms in buildings of residential occupancy or that are used for sleeping, shall conform to Table 9.7.1.2. The requirements in this Table vary depending upon whether or not electrical lighting is provided in the room and the location of the room.

STAIRS, RAMPS, HANDRAILS AND GUARDS (Section 9.8.)

This section applies to the design and construction of interior and exterior stairs, steps, ramps, railings and guards.

Section 9.8 is broken down into the following subsections: 9.8.1. Application, 9.8.2. Stair Dimensions, 9.8.3. Stair Configurations, 9.8.4. Step Dimensions, 9.8.5. Ramps, 9.8.6. Landings, 9.8.7. Handrails, 9.8.8. Guards. 9.8.9. Construction, and 9.8.10. Cantilevered Pre-cast Concrete Steps.

The Subsection 9.8.9. Construction, includes Articles describing loads on stairs and ramps, construction requirements for exterior concrete stairs, exterior wood stairs, wooden stair stringers, treads and finishes for treads, landings and ramps.

Lighting Outlets (Subsection 9.34.2.)

This subsection covers requirements for lighting of entrances and the provision of exterior lighting outlets, light outlets in dwelling units, lighting of stairways, basement lighting, lighting for storage rooms, garages and car ports, and lighting outlets for public or service areas in buildings, including recreational camps and camps for housing workers.

Article 9.34.2.7. includes a Table with prescriptive lighting requirements for public areas which defines the minimum illumination levels in lux, and the minimum lighting power density per floor area measured in Watts per metre squared for incandescent lighting.

18.5 RESOURCE CONSERVATION (Part 12)

The requirements of Division B, Part 12 apply to all buildings. This Part applies to resource conservation in the design and construction of buildings [12.1.1.2.(1)].

Energy Efficiency Design (Subsection 12.2.1.)

Energy Efficiency Design Before January 1, 2012

The following requirements apply to construction for which a permit has been applied for before January 1, 2012. The energy efficiency of all buildings shall be designed to good engineering practices described in:

a) The ANSI/ASHRAE/IESNA 90.1, "Energy Standard for Buildings Except Low-rise Residential Buildings", and Supplementary Standard SB-10, OR
b) The CCBFC, "Model National Energy Code for Buildings" and Supplementary Standard SB-10 [12.2.1.1.(2)].

Energy efficiency design does not apply to farm buildings and buildings intended primarily for manufacturing or commercial or industrial processing [12.2.1.1.(5)].

Energy Efficiency Design After December 31, 2011

After December 31, 2011, the energy efficiency of all buildings shall be designed to exceed by not less than 25% the energy efficiency levels attained by conforming to the CCBFC, "Model National Energy Code for Buildings" [12.2.1.2.(1) and (2)].

These requirements do not apply to farm buildings and *buildings intended primarily for* manufacturing or commercial or industrial processing [12.2.1.2.(5)].

Motion Sensors (Subsection 12.2.2.)

The requirements for motion sensors are found in Article 12.2.2.1. According to Sentence (1), lighting installed to provide the minimum illumination levels required by the Code may be controlled by motion sensors except for the following locations:

a) where lighting is installed in an exit,
b) where lighting is installed in a corridor serving patients or residents in a Group B, Division 2 or 3 occupancy, OR
c) where lighting is required to conform to Sentence 3.2.7.1.(5).

Sentence (2) indicates, where motion sensors are used to control minimum lighting in a public corridor, or corridor providing access to exit for the public, a motion sensor shall be installed with switch controllers equipped for fail-safe operation and illumination timers for a minimum 15 minute duration.

Sentence (3) indicates, a motion sensor shall not be used to control emergency lighting.

WATER EFFICIENCY (Section 12.4.)

According to Sentence 12.4.1.1.(1), all buildings must conform to the water efficiency requirements of Subsection 7.6.4.

Subsection 7.6.4. describes water efficiency ratings and maximum flow rates and pressures in flow rates and test pressures for fittings such as lavatory faucets, kitchen faucets and shower heads. Article 7.6.4.2. provides maximum flush cycles for sanitary fixtures.

Supplementary Standard SB-10

Supplementary Standard SB-10 is the energy efficiency supplement and it forms a part of the requirements contained in Part 12, Division B, Resource Conservation.

SB-10 includes three chapters, Chapter 1, General; Chapter 2, Supplement to ANSI/ASHRAE/IESNA Standard 90.1 and Chapter 3, Supplement to MNECB (Model National Energy Code for Buildings, 1997).

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT'S MODULE 19

LARGE BUILDINGS - 2006

SAMPLE EXAM QUESTIONS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syliabi, as well as reading and reviewing the Code.

QUESTIONS

1. According to Part 3 of the Building Code, where a linen chute discharges into a room, the room must be separated from the remainder of the building by a fire separation with a fire-resistance rating of not:

   a) more than 2 h
   b) not less than 1 h
   c) more than 1 h
   d) not less than 2 h

2. According to Subsection 3.10.2. of the Building Code, a non-sprinklered self-storage building must be subdivided into areas by a masonry wall so that the first storey is not:

   a) more than 500 m^2
   b) not more than 500 m^2
   c) more than 1000 m^2
   d) less than 1000 m^2

3. According to Section 3.7 of the Building Code, a camp for housing workers shall have a sleeping area of not less than:

   a) 3.72 m^2 per employee in every room used for sleeping
   b) 16.72 m^2 per employee in every room used for sleeping
   c) 2.79 m^2 per employee
   d) 29.73 m^2 per unit

4. A bank of five wall-hung public telephones is provided in a mall entrance vestibule. Telephones are provided with counters at varying heights. What is the maximum height of the telephone receiver measured from the top of the counter that is required to be barrier-free accessible?

   a) 515 mm
   b) 350 mm
   c) 250 mm
   d) 335 mm

5. What component of a fire alarm system, required by Subsection 3.2.4., "Fire Alarm and Detection Systems", is not required in a rapid transit station?

   a) central supervising station
   b) voice communication messages
   c) manual pull stations
   d) fire detectors

6. A building has columns located partly outside of the exterior face of a building. The Code requires the structural members to be protected when they are located:

   a) less than 3 m from the property line
   b) less than 2 m from the property line
   c) greater than 3.2 m from the property line
   d) greater than 4 m from the property line

7. Consider a public pool where 50% of the pool is deeper than 1350 mm and the pool water surface area measures 10 m x 35 m. According to Article 3.1.17.3., the occupant load of the pool is:

   a) 195
   b) 458
   c) 790
   d) 229

8. Which one of the following major occupancies is exempt from being considered a major occupancy, as per Article 3.2.2.8.?

   a) Group F, Division 1 major occupancy comprising 9% of the floor area of the storey in which it is located
   b) Helicopter pad comprising an area equivalent to 11% of the area of the roof on which it is located
   c) Group D major occupancy comprising an aggregate area equivalent to 10.5% of the floor area of the storey in which it is located
   d) Group E major occupancy having an aggregate area of 8% of the floor area of the storey on which it is located

9. According to Subsection 3.2.4., all:

   a) Group B-3 occupancies are required to be provided with a 2 stage system
   b) Group B-3 occupancies can either be provided with a single stage or 2 stage system
   c) Group B-3 occupancies in buildings more than 3 storeys in building height are required to be provided with a 2 stage system
   d) Group F occupancies are required to be provided with a single stage fire alarm system

10. According to Article 3.10.4.5. of the Building Code; single storey, sprinklered, self-storage buildings are required to be provided with hydrants located:

    a) adjacent to at least 50% of the building perimeter
    b) such that a fire department pumper vehicle can be located adjacent to the hydrant within 45 m of the fire department connection
    c) around the building to provide firefighters with an unobstructed path of travel of not more than 90 m to the main entrance
    d) within 45 m of the main entrance

11. A tent need not conform to Sections 3.3 and 3.4 for means of egress when the tent:

    a) exceeds an area of 225 m^2
    b) has an occupant load of more than 60 persons
    c) is provided with swing type doors
    d) is provided with flap type doors

12. What is the required fire protection rating of a fire damper used as a closure in a fire separation with a 2 h fire-resistance rating?

    a) 2 h
    b) 45 min
    c) 1½ h
    d) 3 h

13. A sprinklered building having a Group F, Division 1 occupancy, has an exterior building face with 24.5% permitted unprotected openings. What is the construction requirement for the exposing building face?

    a) 45 min fire-resistance rating, clad with noncombustible cladding
    b) 45 min fire-resistance rating
    c) 1 h minimum fire-resistance rating, clad with noncombustible cladding
    d) 2 h fire-resistance rating, clad with noncombustible cladding

14. What is a Part 11 compliance alternative for the requirement in Sentence 3.6.2.1.(7) for service rooms to be separated from the remainder of the building by a fire separation having a fire-resistance rating not less than 1 h, in an assembly occupancy?

    a) existing fire separation is acceptable
    b) existing fire separation with a fire-resistance rating of at least 30 min is acceptable
    c) no fire separation is required
    d) there is no compliance alternative

15. According to Article 3.3.1.4., if a storey is sprinklered, no fire resistance rating is required for fire separations between a public corridor and the remainder of the storey provided the public corridor:

    a) is not more than 9 m in unobstructed width
    b) serves a residential occupancy
    c) does not serve a care or detention occupancy
    d) is more than 3 m in unobstructed width

16. According to Sentence 3.4.2.1.(2), a sprinklered floor area in a 2 storey office building with an occupant load of 25, and a maximum travel distance to the exit of 25 m, is permitted to be serviced by one exit if the maximum floor area is:

    a) 200 m^2
    b) 300 m^2
    c) 100 m^2
    d) 150 m^2

17. According to Section 3.12., where a set of steps is provided for entry into and egress from a public spa, the steps must be equipped with:

    a) handrails on both sides
    b) a handrail with a height of not less than 900 mm
    c) a guard
    d) a handrail

18. A vapour barrier is not required where it can be shown that uncontrolled vapour diffusion will not adversely affect:

    a) the fire-resistance rating of the exterior wall
    b) the flame spread rating of the interior wall finishes
    c) the health or safety of the building users
    d) the thermal barrier system

19. In accordance with SB-2, what is the fire-resistance rating of a ceiling membrane comprised of double 12.7 mm Type X gypsum wallboard?

    a) 30 min
    b) 90 min
    c) 45 min
    d) 50 min

20. According to Section 3.7 of the Building Code, play activity rooms in a child care facility shall have:

    a) windows that open to the exterior
    b) one or more windows with a total unobstructed glass area of not less than 20% of the area of the room
    c) a skylight
    d) one or more windows with a total unobstructed glass area of not less than 10% of the area of the room

21. An elevator hoistway shall be separated from all other portions of each adjacent storey by a fire separation having a fire-resistance rating conforming to Table 3.5.3.1 for the:

a) floor assembly above the storey
b) wall assembly above the storey
c) roof assembly
d) exit stair shaft

22. In accordance with Article 3.13.3.5., what is the required fire-resistance rating of a fire separation located between a rapid transit station and an adjoining vehicle terminal?

a) 45 min
b) 1½ h
c) 1 h
d) 2 h

23. A sign structure is required to be designed in accordance with Part 4 of the Code, except when the sign:

a) weighs less than 110 kg
b) is painted on the face of a building
c) is 7.6 m in height above finished grade
d) has an area more than 10 m^2

24. According to Article 3.2.2.10., every building must face a street such that the principal entrance and every access opening are located the following distance from the closest portion of the access route required for fire department use:

a) not less than 3 m
b) not less than 15 m
c) between 3 m and 15 m
d) not more than 15 m

25. Select the most appropriate construction classification for the following building: Group D, 2 storeys in building height, 700 m^2 in building area, facing 1 street and unsprinklered:

a) Article 3.2.2.51. "Group D, up to 6 Storeys, Sprinklered"
b) Article 3.2.2.53. "Group D, up to 3 Storeys"
c) Article 3.2.2.55. "Group D, up to 2 Storeys"
d) Article 3.2.2.56. "Group D, up to 2 Storeys, Sprinklered"

26. What is the assigned flame spread rating and smoke developed classification for 11 mm thick, unfinished, Douglas fir plywood without a cellulose resin overlay, manufactured in accordance with the standard CSA O121?

a) 25/50
b) 150/300
c) 0/0
d) 150/100

27. The following is not considered an exit:

a) a fire escape conforming to Subsection 3.4.7.
b) an exterior passageway
c) an interior stairway
d) a service ladder in a shaft used as a plenum for a heating, ventilating or air-conditioning system

28. According to the tables used for compliance alternatives in a hospital, existing functionally operable latching devices (excluding draw bolts) are acceptable as a compliance alternative to the following Part 3 requirement:

a) Article 3.1.8.13.
b) Article 3.1.8.14.
c) Article 3.1.8.15.
d) Article 3.1.8.16.

29. What is the minimum dimension of a special barrier-free washroom?

a) 1500 mm
b) 1700 mm
c) 1400 mm
d) 1020 mm

30. What is the occupant load of an office occupying 100 m^2 of floor area in an office building?

a) 11 persons
b) 22 persons
c) 100 persons
d) 2 persons

ANSWERS

1. b) [3.6.3.3.(7)]
2. b) [3.10.2.3.(2)]
3. a) [3.7.1.4.(2)]
4. d) [3.8.3.15.(2) and (3)]
5. c) [3.13.5.2.(1)]
6. a) [3.2.3.9.(1)]
7. a) [3.1.17.3.(1)]
8. d) [3.2.2.8.(1)]
9. c) [3.2.4.3.(1)(b)]
10. b) [3.10.4.5.(3), 3.10.3.4.(3)(a)]
11. d) [3.14.1.3.(1)]
12. c) [3.1.8.4.(2)]
13. d) [3.2.3.7.(5)]
14. b) [compliance alternative A 54]
15. c) [3.3.1.4.(3)]
16. b) [3.4.2.1.(2)(b)]
17. d) [3.12.2.1.(7)(a)]
18. c) [5.5.1.1.(3)(a)]
19. c) [SB-2 - 2.3.12.]
20. d) [3.7.2.1.(3)]

21. a) [3.5.3.1.(1)]

22. c) [3.13.3.5.(1)(b)]

23. b) [3.15.3.1.(1), 3.15.1.2.(1)(d)]

24. c) [3.2.5.5.(1)]

25. c) [3.2.2.55.]

26. d) [SB-2, Table 3.1.1.A]

27. d) [3.4.1.4.(1)]

28. a) [3.1.8.13.(1), CA-B11]

29. b) [3.8.3.12.(1)(f)]

30. a) [Table 3.1.17.1]

Ontario

Ministry of Municipal Affairs and Housing

ANSWERS TO EXERCISE QUESTIONS

LARGE BUILDINGS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

MODULE 1

INTRODUCTION AND INSTRUCTIONS ADMINISTRATIVE REQUIREMENTS

EXERCISE #1-1

1. Provide the objectives and functional statements attributed to the following (acronyms only required):

a) 3.3.1.20.(1) ________________ [________________]

b) 3.8.3.3.(3) ________________ [________________]

c) 4.1.5.15.(3) ________________ [________________]

d) 6.3.1.2.(2) ________________ [________________]

Answers

a) F03- OP1.2, F03-OS1.2 [SA-1, Table 3]

b) F10- OS3.7, F74-OA2 [SA-1, Table 3]

c) None provided [SA-1, Table 4]

d) F01- OP1.1, F01- OS1.1[SA-1, Table 6]

2. What is objective OS1.3? What category?

An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by the collapse of physical elements due to a fire or explosion. Category – Fire Safety [Div. A, Table 2.2.1.1]

3. What is functional statement F12?

To facilitate emergency response [Div. A, Table 3.2.1.1]

MODULE 2

OCCUPANCY, CONSTRUCTION TYPES, FIRE-RESISTANCE, OCCUPANT LOAD

Minimum Fire-Resistance Rating of Fire Separations Between Adjoining Major Occupancies

Schematic of uses for a multi-storey building not regulated by Subsection 3.2.6. Indicate FRRs (in hours) beside arrows.

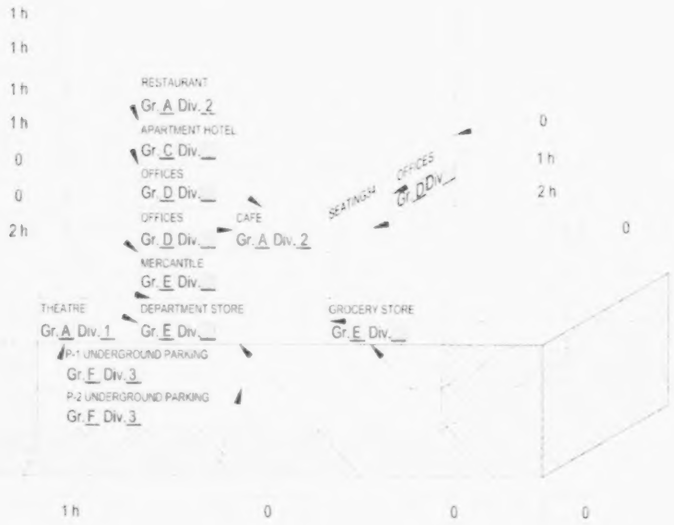

1 h
1 h
1 h
1 h
0
0
2 h
RESTAURANT
Gr. A Div. 2
APARTMENT HOTEL
Gr. C Div.__
OFFICES
Gr. D Div.__
OFFICES
Gr. D Div.__
CAFE
Gr. A Div. 2
MERCANTILE
Gr. E Div.__
THEATRE
Gr. A Div. 1
DEPARTMENT STORE
Gr. E Div.__
GROCERY STORE
Gr. E Div.__
P-1 UNDERGROUND PARKING
Gr. F Div. 3
P-2 UNDERGROUND PARKING
Gr. F Div. 3
SEATING
OFFICES
Gr. D Div.__
0
1 h
2 h
0
1 h
0
0
0

FIGURE 2-1

EXERCISE #2-1

Examine Figure 2-1. Take about 15 minutes to determine the major occupancy classification and the minimum fire-resistance rating for the fire separations between the adjoining major occupancies. Write your answers on the Drawings. Are your determinations the same as those of the rest of the group?

You will observe that some combinations do not represent a hazard to each other. Consequently, the Table does not call for a fire separation. For this exercise, we are not concerned with other types of fire separations. Have group discussions as required. Class discussions will begin in about 15 minutes.

Notes:

Table 2-1 can be used as a reference for determining the minimum required fire-resistance rating for a fire separation between adjoining major occupancies.

EXERCISE 2-2

1. Define the term 'horizontal service space'.

   . . . a space such as an attic, duct, ceiling, roof or crawl space oriented essentially in a horizontal plane, concealed and generally inaccessible, through which building service facilities such as pipes, ducts and wiring may pass [Division A, Article 1.4.1.2.].

2. Figure 2-3 illustrates the general rule of Sentence 3.1.8.3.(1). In the space provided, explain in your own words the general rule for horizontal service spaces or other concealed spaces located above a required vertical fire separation, including the wall of a shaft.

   General rule, Sentence 3.1.8.3.(1): Vertical fire separations and vertical shaft walls that are vertical fire separations shall be continuous through horizontal service spaces.

3. Figure 2-4 illustrates the exception contained in Sentence 3.6.4.2.(2) to the general rule for a horizontal service space or other concealed space located above a required vertical fire separation that is not the wall of a vertical shaft. Explain what the OBC requires when a vertical fire separation terminates at the underside of a horizontal service space.

A vertical fire separation not part of a vertical shaft may terminate on the underside of a horizontal service space, provided that the construction between the HSS and VFS has an FRR equivalent to the VFS.

Limitation to this exception: When the FRR of a VFS is not required to exceed 45 min, the FRR of the construction between the HSS and the VFS can be reduced to 30 min. [Sentence 3.6.4.2.(2)]

EXERCISE #2-3

1. When it comes to self-closing devices, specify the general rule for doors in a fire separation (other than doors to freight elevators and dumbwaiters).

   Every door in a fire separation shall be equipped with a self-closing device designed to return the fire door to the closed position after each use [Sentence 3.1.8.11.(1)].

2. There are four exceptions to this general rule. Name three locations where self-closing devices need not be provided on fire doors, and specify any applicable condition. (Do not deal with sprinklered hospitals and nursing homes.)

   Self-closing devices need not be provided on doors located between:

   - *Doors to freight elevators or dumbwaiters [Sentence 3.1.8.11.(2)].*
   - *Nonhazardous classrooms and access-to-exit corridors in schools three storeys or less in building height [Sentence 3.1.8.11.(3)].*
   - *Rooms of D occupancy and public corridors (but not in a dead-end portion of a public corridor) in a building of three storeys or less [Sentence 3.1.8.11.(4)].*
   - *A door that is located between:*
     - *A patient's/resident's sleeping room and the serving corridor, OR*
     - *A patient's/resident's sleeping room and an adjacent sleeping room*

     In a fire compartment in a hospital or nursing home complying with Article 3.3.3.5.

EXERCISE #2-4

1. State the general rule governing the latching mechanism of every swing-type door in a fire separation.

   Every swing-type door in a fire separation shall be equipped with a positive latching mechanism designed to hold the door in the closed position after each use [Sentence 3.1.8.13.(1)].

2. There are exceptions to this general rule, as certain doors in a fire separation are not required to be equipped with a positive latching mechanism. Describe their location and state any application condition.

   In hospitals/nursing homes, roller latches are permitted on doors between patients' bedrooms and adjacent rooms, and between corridors serving patients' bedrooms and adjacent rooms within a fire compartment [Sentences 3.3.3.5.(5) and 3.3.3.5.(11)].

EXERCISE #2-5

1. State the two general rules that dictate when a fire damper must be installed in a duct.

   - *When the duct connects two fire compartments.*
   - *When it penetrates an assembly required to be a fire separation [Sentence 3.1.8.7.(1)].*

2. Where a fire damper acts as a closure, explain how the required fire protection rating is determined.

   Sentence 3.1.8.4.(2), Table 3.1.8.4. Follow the same procedure used to determine the FPR of a closure in a fire separation with an FRR.

3. The OBC tells us that fire dampers tested in the vertical or horizontal position must be installed in the manner in which they were tested. Additionally, they are to be installed in the plane of the fire separation, so as to stay in place should the duct be dislodged during a fire. To which standard are they tested?

   According to Sentence 3.1.8.4.(1)(c), they are tested to CAN/ULC-S112-M, "Fire Test of Fire Damper Assemblies".

4. Consider a noncombustible branch duct with a melting point above 760°C that penetrates a required fire separation. Would a fire damper be required if the duct served only a heating unit?

   Yes. The exception of Clauses 3.1.8.8.(1)(a) and (b) applies when the ducts serve only air-conditioning units or *combined air-conditioning and heating units* or *they are connected to exhaust duct risers under negative upper air flow.*

5. There are a number of situations in which a duct either connects two fire compartments or penetrates an assembly required to have a fire-resistance rating, but does not require a fire damper to ensure the continuity of the fire separation.

a) Serving air-conditioning units or combined air-conditioning units and heating units. Four conditions apply. State them.

- *In noncombustible branch ducts*
- *Having a melting point above 760°C*
- *Discharging air not more than 1.2 m above the floor, and*
- *Having a cross-sectional area of not more than 0.13 m^2 [Clause 3.1.8.8.(1)(a)].*

b) Fire dampers can be omitted from branch ducts that are connected to exhaust duct risers. State the conditions that must be adhered to.

- *In noncombustible ducts*
- *With a melting point above 760°C, and*
- *Are connected to exhaust-duct risers which are under negative pressure, with a fan located at or near the exhaust outlet (3.6.3.4.(1)), with branch ducts carried up inside the riser not less than 500 mm.*

EXERCISE #2-6

1. Consider Table 3.1.8.15. and make a list of the locations where the use of a fire door is regulated by the maximum temperature rise on the opaque portion of the unexposed side of the fire door.

   - *When located between a dead-end corridor and an adjacent occupancy where the corridor provides the only access to exit and is required to have a fire-resistance rating.*
   - *When located between an exit enclosure and the remainder of the floor area, in a building more than three storeys in building height.*
   - *When located in a firewall.*

2. Specify the three conditions that waive the temperature rise limitations for a fire door located between an exit enclosure and an enclosed vestibule, or between an exit enclosure and a corridor, or between an exit enclosure and the remainder of the floor area in a building not more than 3 storeys in building height.

   1. *The vestibule or corridor adjacent to an exit enclosure is separated from the remainder of the floor area by a fire separation with at least 45 min of FRR [Clause 3.1.8.17.(1)(a)], AND*

   2. *The fire separation of the vestibule/corridor has no wired glass/glass block assemblies within 3 m of the closure into the exit enclosure [Clause 3.1.8.17.(1)(b)], AND*

3. *The vestibule/corridor contains no occupancy [Clause 3.1.8.17.(1)(c)].*

EXERCISE 2-7

1. When a service penetration as described in Sentence 3.1.9.1.(1) is not tightly fitted, describe the firestop system required and explain how its fire protection rating is determined.

   Sealed by a firestop system with an F rating not less than the FPR required for the closure in the fire separation, when tested in accordance with ULC-S115-M, "Fire Tests of Firestop Systems" [Clause 3.1.9.1.(1)(a)].

2. Sentence 3.1.9.1.(2) deals with service penetrations of two particular types of fire separations.

   a) In your own words, describe the two types of fire separations.

      - *A firewall.*
      - *A horizontal fire separation required to have an FRR in conformance with Article 3.2.1.2., which allows a parking garage to be considered as a separate building for purposes of Subsection 3.2.2.*

   b) When a service penetrates a firewall or a horizontal fire separation whereby a storage garage is considered a separate building, the service penetration of piping, tubing, ducts, chimneys, electrical wires and cables, totally enclosed in noncombustible conduits, electrical outlet boxes and similar building services are not simply permitted to be tightly fitted. Describe the firestop system required and explain how its fire protection rating is determined.

      A firestop system with an FT rating not less than the FRR of the fire separation, when tested in accordance with ULC-S115-M, "Fire Tests of Firestop Systems".

EXERCISE 2-8

1. An opening is made through the membrane of a fire separation that is required to have a fire-resistance rating, in order to install a combustible outlet box. Specify the maximum untested size of the opening.

   160 cm^2 [Sentence 3.1.9.3.(5)]

2. What must be done when outlet boxes penetrate opposite sides of the same fire separation?

   They shall be offset (not in the same stud spacing) to maintain the integrity of the fire separation [Sentence 3.1.9.3.(6)].

3. Under which condition can wiring of any size, with unrated combustible insulation, jackets or sheathes, be permitted to partly or wholly penetrate an assembly required to have a fire-resistance rating without the benefit of a test?

   When the wiring is totally enclosed in a noncombustible conduit [Sentence 3.1.9.3.(1)].

4. Consider the electrical wires or cables, single or grouped, not totally enclosed in noncombustible conduit, with combustible insulation, jackets or sheathes, which are permitted to partly or wholly penetrate an assembly required to have a fire-resistance rating without being incorporated in the assembly at the time of testing, provided that two conditions are complied with. Specify them.

   - *Provided the overall diameter of the single or grouped wires or cables is not more than 25 mm [Sentence 3.1.9.3.(2)].*
   - *Provided the wires or cables are rated FT4 or FT6 [Clause 3.1.5.17.(1)(a)].*

EXERCISE #2-9

1. Illustrations A and B in Figure 2-5 reveal that the connected roof assemblies adjoining the firewall do not have a verifiable fire-resistance rating. Specify the Code requirement for the design of the firewall-roof connection.

   The connections and supports for such members with a FRR less than that required for the firewall must be designed so that the collapse of the framing members during a fire will not cause the collapse of the firewall [Sentence 3.1.10.1.(1)].

2. Illustrations A and B in Figure 2-5 reveal that the connected roof assemblies adjoining the firewall do not have a verifiable fire-resistance rating. Specify the Code requirement for the design of the firewall-roof connection.

   When the building is of noncombustible construction and the supporting structural frame has an FRR not less than that required for the firewall [Sentence 3.1.10.1.(3)].

EXERCISE #2-10

1. Use your pen to highlight the 'floor area' part of the floor plan.

   Entire area minus the exit stair shafts and elevator shaft.

2. Calculate the floor area in Figure 2-6.

   Length = 7.5 X 5 = 37.5 – 0.6 = 36.9 m
   Width = (6 X 3) + 2.8 = 20.8 – (1.5 + 0.6) = 18.7 m
   Area = 36.9 X 18.7 = 690.03 m^2
   MINUS 5.25 X 1.75 = 9.19 m
   2(2.8 X 4.6) = 25.76 m
   Floor Area = 690.03 – 34.95 = 655.08 m^2

EXERCISE #2-11

Assume that the floor area of a large restaurant dining area is 800 m^2. From Table 3.1.16.1., calculate the occupant load of the dining area.

MODULE 3

SUPPLEMENTARY STANDARD SB-2 - FIRE PERFORMANCE RATINGS

EXERCISE #3-1

Review SB-2 and locate the Subsection(s) that covers the following material:

1. Minimum equivalent thickness for fire-resistance rating of masonry and concrete walls.

   [1.6.1. and 2.1.1.]

2. Fire-resistance rating of composite slabs comprised of reinforced or pre-stressed concrete.

   [2.2.3.]

3. Limitations of the 'component additive method' for wood and steel framed walls, floors and roofs.

   [2.3.3.]

4. Effect of addition of plaster to reinforced concrete columns.

[2.8.5.]

5. Requirements for flame-spread ratings and smoke developed ratings.

   [3.1.1.]

6. Hold-open devices for firestop flaps.

   [5.3.2.]

EXERCISE #3-2

1. For the masonry unit (concrete block) shown in Figure 3-1, calculate the equivalent thickness. Give SB-2 Sentence(s) used.

   Volume of voids = $120 \times 150 \times 200 \times (2)$
   = $7{,}200{,}000\ \text{mm}^3$

   Gross volume of block = $400 \times 200 \times 200$
   = $16{,}000{,}000\ \text{mm}^3$

   Net volume = $16{,}000{,}000 - 7{,}200{,}000$
   = $8{,}800{,}000\ \text{mm}^3$

   Equivalent thickness = $200\ \text{mm thick} \times \dfrac{8.8}{16}$
   = $110\ \text{mm}$

   110 mm [1.6.1.(3), (4), (5)]

2. If a wall is constructed using the block described in 1., and has a 12 mm layer of portland cement-sand plaster finish added to each face, what is the equivalent thickness of the finished wall? Give SB-2 Sentence(s) used.

   110 mm + 12 mm + 12 mm = 134 mm [1.6.1.(2)]

EXERCISE #3-3

Calculate the fire-resistance rating for the non-loadbearing wall assembly shown on the attached Figure 3-2. Give SB-2 references for your answer.

- *Contribution of 15.9 mm Type X gypsum board:*

40 min *[Table 2.3.4.A]*

- *Contribution of steel studs at 300 mm oc*
  10 min *[Table 2.3.4.C]*
- *Contribution of rock fibre insulation*
  0 *[Table 2.3.4.D]*
  (Only contribution if wood studs used)

Total rating: *50 min*

EXERCISE #3-4

Calculate the mass/heated perimeter (M/D) ratio for the two steel columns shown in Figure 3-3 and determine their maximum fire-resistance rating, if they are protected with 38.1 mm of Type X gypsum wallboard, and installed in accordance with 2.6.5. The mass of column (a) is 22.4 kg/m and the mass of column (b) is 113 kg/m.
Give SB-2 references with your answers.

Figure 3-3 (a) $M = 22.4$ kg/m

$D = 2(B + H) = 2(.102 + .206)$

$= 0.616$ m

$M/D = \frac{22.4}{.616} \frac{kg/m}{m} = 36.4 (kg/m)/m$

Maximum FRR = 1.5 h [Table 2.6.1.F]

Figure 3-3 (b) $M = 113$ kg/m

$D = 2(B + H)$

$= 2(.305 + .305)$

$= 1.22$ m

$M/D = \frac{113}{1.22} \frac{kg/m}{m} = 92.6 (kg/m)/m$

Maximum FRR = 2 h *[Table 2.6.1.F]*

EXERCISE #3-5

For the following material types, and minimum thickness of application to a steel beam, determine the maximum fire-resistance rating. (Give SB-2 reference.)

1. Cover comprised of gypsum-sand on metal lath with air gap between plaster and lower

flange of steel beam, applied to a thickness of 16 mm.

1 h (Table 2.7.1)

2. Steel beam encased in Type N concrete (cast-in-place) such that the beam spaces are filled solid. The minimum thickness of cover is 39 mm.

   3 h (Table 2.7.1)

3. What is the maximum fire-resistance rating for a steel beam protected by a membrane ceiling that contributes to the overall fire-resistance rating of the assembly, where the rating of the ceiling membrane is determined using Section 2.3 of SB-2 [see 2.3.3.(2) for limitations].

   1.5 h (2.7.5)

EXERCISE #3-6

1. What is the flame spread rating of 6 mm thick Type 1 Standard hardboard? Give material Standard in your answer.

   150 (CGSB-11.3)

2. What is the smoke developed classification of woven wool carpet, with a pile weight of 1500 g/m^2, applied without felt underlay? Give material Standard in your answer.

   300 (CAN/CGSB-4.129)

MODULE 4

BUILDING FIRE SAFETY - PART 1

EXERCISE #4-1

1. Select the correct condition under which visual obstructions above 1,070 mm in height are permitted on a 40% (open) mezzanine.

   a) 40% (open) mezzanine, Group D office occupancy with filing cabinets at 1,080 mm above the mezzanine floor.

b) 40% (open) mezzanine, Group A, Division 1 occupancy with viewing screen at 2,100 mm in height above the mezzanine floor.

c) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,000 mm above the mezzanine floor and 80% of the floor-to-ceiling height of the space above the floor assembly.

d) 40% (open) mezzanine, Group A, Division 2 library occupancy with bookshelves 2,100 mm above the floor of the mezzanine and 70% of the floor-to-ceiling height of the space above the mezzanine floor assembly.

d) Obstructions exceeding 1070 mm in height above the mezzanine floor are permitted in libraries. However, the requirements of Sentence 3.3.2.11.(3) must be met. Specifically, the height of the shelves must not exceed 2100 mm and must not exceed more than 75% of the floor-to-ceiling height of the space above or below the mezzanine floor assembly [Clause 3.2.1.1.(3)(b), Sentence 3.3.2.11.(3)].

2. Are visual obstructions exceeding 1070 mm above the floor of a mezzanine that is 33% of the storey in which it is located, always prohibited? If not, provide support, with Code references, for your answer.

   Obstructions exceeding 1070 mm in height above the mezzanine floor are permitted in libraries, or if the enclosed space has an area less than 10% of the open area of the room in which the mezzanine is located, provided the enclosed space does not obstruct visual communication between the open space above the mezzanine and the room in which it is located. In libraries, the requirements of Sentence 3.3.2.11.(3) must be met. Specifically, the height of the shelves must not exceed 2100 mm and not more than 75% of the floor-to-ceiling height of the space above or below the mezzanine floor assembly [Clause 3.2.1.1.(3)(b), Sentence 3.3.2.11.(3)].

3. Review Figure 4-9. Does the mezzanine satisfy the requirement(s) for exemption as a storey? Provide support, with Code references, for your answer.

   The mezzanine does not meet the requirements for exemption as a storey per Sentence 3.2.1.1.(4) and Sentence 3.2.1.1.(5). Although the aggregate area of the mezzanines is less than 10% of the ground floor storey in which it is located, one of the mezzanines is partially superimposed above another. Therefore, the mezzanine level above the first mezzanine must be considered as a storey [Sentence 3.2.1.1.(4), Sentence 3.2.1.1.(5)].

4. In a building of Group C (residential) major occupancy, a laundry room for the use of building occupants is located within the rooftop enclosure. The laundry room comprises 15% of the area of the rooftop enclosure. Must the rooftop enclosure be considered as a storey? Select the most correct answer from the options below.

a) No, this rooftop occupancy is not required to be considered as a storey.
b) Yes, the rooftop laundry room must be considered as a storey because it comprises more than 10% of the area of the roof on which it is located.

c) Yes, the rooftop laundry room must be considered as a storey as it is not a service room.

d) No, this rooftop enclosure is not required to be considered as a storey because it is only for building occupants.

b) Yes, the rooftop enclosure containing the laundry room must be considered a storey, as this type of use is not considered a service room [Sentence 3.2.1.1.(1), Article 1.4.1.2. "Service Room"], [Appendix A-1.4.12. "Service Room"].

5. Review Figure 4-10 and select the most correct answer.

a) Each mezzanine must be considered as a storey. Therefore, the mezzanines contribute 3 additional storeys.

b) The mezzanines are open and therefore do not contribute any additional storeys.

c) Since mezzanines B and C are located at different heights from the floor, one additional storey must be added to the building height.

d) Mezzanines A and B are superimposed. Therefore, mezzanine A must be considered as a storey.

d) The mezzanines are usually "open" (i.e. no visual obstructions over 1070 mm). The aggregate area of the mezzanine is less than 40% but more than 10%. Although the two lower mezzanines (mezzanines B and C) are at differing heights from the floor level, they are at opposite sides of the room (i.e. not superimposed). However, the superimposed mezzanine (mezzanine A) must be considered as a storey; this adds one additional storey to the building height.

[Sentence 3.2.1.1.(3), Sentence 3.2.1.1.(4) and Sentence 3.2.1.1.(5)]

EXERCISE #4-2

1. Referring only to Sentence 3.2.1.2.(1), identify the criteria which would permit consideration of a storage garage as a separate building? Provide a code reference with your answer.

    - *Basement level*
    - *Used primarily as a storage garage*
    - *Floor and roof assemblies above the basement are fire separations having a 2 hour fire-resistance rating and constructed of masonry or concrete*
    - *Exterior walls of the basement, if above the adjoining ground level, are constructed as fire separations of masonry or concrete having a fire-resistance rating of not less than 2 hours*
    - *[Sentence 3.2.1.2.(1)]*

EXERCISE #4-3

Using the information provided in Tables 4-2 and 4-3 in combination with reference to the Building Code, as applicable, answer the following questions.

1. If a building contains more than one major occupancy (and these major occupancies are not superimposed, however, are more than 10% of the floor area), which requirements are applied in determining the construction classification of the building? Provide a Code reference with your answer.

    The requirements of the most restrictive major occupancy must apply to the whole building [Sentence 3.2.2.6.(1)].

2. Consider Figure 4-12. Identify the number of streets the building faces. Include a Code reference to support your decision.

    a) 1 street
    b) 2 streets
    c) 3 streets
    d) 4 streets

    b) 2 streets, building perimeter:

    100 m + 50 m + 100 m + 50 m = 300 m

    Perimeter within 3 m to 15 m of a street:
    100 + 50 + 12 + 10 = A2

$$\% = \frac{A2}{300} = 57\%$$

The building faces 2 streets as 57% of the building perimeter is located between 3 m to 15 m of the streets bordering the building [Sentence 3.2.2.10.(3)].

3. A shopping mall contains 3 storeys below grade. The below grade storeys contain retail (Group E) occupancies. Identify the most appropriate fire-resistance rating criteria for the floor assemblies below the ground floor. Provide Code references with your answer.

   a) The below grade floor assemblies must have a fire-resistance rating of 2 h.

   b) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h.

   c) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 2 h if the building is sprinklered.

   d) The below grade floor assemblies must be constructed as fire separations having a fire-resistance rating of 3 h.

   d) The floor assemblies below the ground floor must be constructed as fire separations having a 3 h fire-resistance rating [Subclause 3.2.2.15.(2)(b)(I)]. Additionally any columns, loadbearing walls and arches supporting these floor assemblies below grade must have fire-resistance ratings of 3 h [Clause 3.2.2.15.(2)(c)].

4. Provide the Code reference and the primary criteria used in determining whether the fire-resistance rating of a roof is permitted to be waived.

   The reference is Sentence 3.2.2.17.(1). The primary criteria are:

   1. *The whole building must be sprinklered*
   2. *The sprinkler system must be electrically supervised in accordance with Sentence 3.2.4.9.(2),* and
   3. *The operation of the sprinkler system will transmit a signal to the fire department in accordance with Sentence 3.2.4.7.(4).*

5. Identify the criteria which require an occupancy to be considered as a major occupancy relative to the application of Articles 3.2.2.20. through 3.2.2.83.

   1. *Aggregate area of all major occupancies in a floor area of the storey exceeds 10% for Group A (all), Group B (all), Group C, Group D, Group E and Group F, Division 3,* or

2. *Major occupancies of Group F, Division 1 or 2, of any area within the floor area of the storey in which they are located,* **or**
3. *Rooftop helicopter landing areas which exceed 10% of the area of the roof.*

[Article 3.2.2.8.]

EXERCISE #4-4

1. Consider the building shown in Figure 4-16 and answer the following questions:
   a) What is the building height?
   b) What is the building area?
   c) Identify the major occupancy classifications.

a) Building height:	*7 storeys*
b) Building area:	*20,000 m²*
c) Major occupancies:	*Group A, Division1; Group A, Division 2; Group C; Group D; Group E; Group F, Division 3*

2. Consider the building shown in Figure 4-17 and select the most appropriate construction classification requirements.

   a) Article 3.2.2.62., Group E up to 2 Storeys, Sprinklered

   b) Article 3.2.2.61. up to 2 Storeys

   c) Article 3.2.2.60., Group E, up to 3 Storeys, Sprinklered

   d) Article 3.2.2.58., Group E up to 4 Storeys, Sprinklered

   c) *Article 3.2.2.60. Group E, up to 3 Storeys, Sprinklered*

3. Identify, with Code reference(s), how many streets must serve a building of the following composition:

   - Group D
   - 3 storeys in building height
   - Building area of 2 100 m²
   - Unsprinklered
   - Combustible construction

   3 streets per Article 3.2.2.53.

4. Identify the most appropriate construction classification Article(s) applicable to Figure 4-18. What fire-resistance rating must the floor assemblies between the major occupancies provide?

Article 3.2.2.43. - Group C, Up to 6 Storeys
Article 3.2.2.52. - Group D, Up to 4 Storeys, Sprinklered
Article 3.2.2.57. - Group E, Any Height, Any Area

Between Group E and Group D major occupancies, the floor assemblies must be constructed as fire separations having a 2 h fire-resistance rating [3.2.2.57.(2)(b), 3.2.2.7.(2)].

Between the Group D and Group C major occupancies, the floor assemblies must be constructed as fire separations having a 1 h fire-resistance rating [3.2.2.52.(2)(a), 3.2.2.7.(2)].

Between the 2nd and 3rd storeys containing the Group D major occupancies, the floor assembly must be constructed as a fire separation having a 1 h fire-resistance rating [3.2.2.52.(2)(a)].

5. Review Figure 4-19 and answer the following questions, providing Code references:

   a) What is the appropriate construction classification?

   b) Is the building permitted to be constructed of combustible construction?

   c) Is noncombustible construction permitted?

   d) What fire-resistance rating is required for floor assemblies if constructed of noncombustible construction?

Building height: 3 storeys
Building area: 110 m x 20 m = 2,200 m^2
Sprinkler protection: Building is not sprinklered
Streets: perimeter - 260 m
perimeter facing a street - 240 m
% = (240 m/260 m) x 100 = 92%
Therefore, the building faces 3 streets per Sentence 3.2.2.10.(4)

a) Article 3.2.2.76. Group F, Division 3, Up to 4 Storeys
b) Yes, the building is permitted to be of combustible construction [Sentence 3.2.2.76.(2)].
c) Yes, noncombustible construction is also permitted [Sentence 3.2.2.76.(2)].

d) *If they are of noncombustible construction, floor assemblies must be constructed as fire separations, although a fire-resistance rating is not required [Clause 3.2.2.76.(2)(a)].*

MODULE 5

BUILDING FIRE SAFETY - PART 2

EXERCISE #5-1

Read Sentences 3.2.3.1.(1), (2), (4), (5), (6), and (7) and Article 3.2.3.2., and consider Figure 5-5. Class discussion begins in 15 minutes.

1. Calculate the area of unprotected opening(s) permitted in the south exposing building face. The known values are as follows:

   - The limiting distance is 4.0 m.
   - Fire Compartment 'A' is 4 m by 7.5 m at the EBF.
   - Fire Compartment 'B' is 8 m by 7.5 m at the EBF.
   - The building is a Group D occupancy.
   - The building is not sprinklered.

   The 1 h fire separation between the D occupancies permits the area of EBF to be calculated for each fire compartment [Sentence 3.2.3.2.(2)].

FIRE COMPARTMENT A

1. LD = 4.0 m
2. The area of fire compartment A = (4 m) x (7.5 m) = 30 m^2
   L/H ratio 7.5/4 = 1.8:1; $\therefore$ < 3:1
   D occupancies.
3. To calculate the permitted area of UO for fire compartment A: Read directly from Table 3.2.3.1.A.

   For an EBF of 30 m^2 with a limiting distance of 4 m, Table 3.2.3.1.A. lists a maximum UO of 35% of the EBF area.

Therefore, the area of UO = 30 m^2 x 35% = 10.5 m^2

Fire compartment A having a 30 m^2 EBF allows a maximum unprotected opening area of 10.5 m^2.

FIRE COMPARTMENT B

1. LD = 4.0 m

2. The area of fire compartment B = (8m) x (7.5 m) = 60 m^2
   L/H ratio 8/7.5 = 1.1:1; $\therefore$ < 3:1
   D occupancies

3. To calculate the permitted area of UO for fire compartment B: Read directly from Table 3.2.3.1.A.

   For an EBF of 60 m^2 with a limiting distance of 4 m, Table 3.2.3.1.A. lists a maximum UO of 21% of the EBF area.

   Therefore, the area of UO= 60 m^2 x 21% = 12.6 m^2

   Fire compartment B having a 60 m^2 EBF allows a maximum unprotected opening area of 12.6 m^2.

EXERCISE #5-2

1. Read Sentences 3.2.3.1.(3) and (4). Review Figure 5-6 and state how you would determine the allowable percentage of unprotected openings when the limiting distance is not constant.

   To determine the percentage of UO, the LD may be taken from the EBF of the building or fire compartment projected onto a vertical plane at the unprotected opening closest to the property line, centre line of a street, or to the imaginary line between two buildings on the same property (i.e. limiting distance is 6.0m) [Sentence 3.2.3.1.(4)].
2. What is the limiting distance that must be used to establish the construction requirement of the exterior wall?

   Limiting Distance = 4.0 m

3. A sprinklered building having a Group E occupancy has an exposing building face with

40% allowed maximum unprotected openings. Describe the construction of the exposing building face.

The exposing building face requires a 1 h fire-resistance rating [Sentence 3.2.3.7.(6)].

4. An unsprinklered building having a Group F, Division 2 occupancy is allowed an exposing building face with 10% maximum unprotected openings. Describe the construction of the exposing building face.

   The exposing building face shall be of noncombustible construction having a fire-resistance rating not less than 2 h and clad with noncombustible cladding [Sentence 3.2.3.7.(4)].

5. A sprinklered building having fire compartments of Group D and Group F Division 1 occupancies has an exposing building face with the following characteristics.

   Group D occupancy has 30% allowable unprotected openings Group F, Division 1 occupancy - 40% allowable unprotected openings.

   Describe the construction of the exposing building faces.

   The Group D occupancy of an exposing building face requires a fire-resistance rating not less than 45 minutes [Sentence 3.2.3.7.(3)].

   The Group F, Division 1 occupancy exposed building face shall have a fire-resistance rating not less than 1 h [Sentence 3.2.3.7.(6)].

EXERCISE #5-3

1. An exit stair enclosure has an opening in the exterior wall. The enclosure forms an angle of 75° with the plane of the exterior wall of the building. The exterior wall of the building also has an opening located 10.5 m horizontally from and 1 m above the opening in the exit.

   Are the openings in the building or exit enclosure required to be protected?

   No. The opening in the building is located more than 3 m horizontally from the opening in the exit enclosure [3.2.3.13.(1)(a) and (b)].

   Although the opening in the building is 1 m above the opening in the exit enclosure, the requirements require openings to be protected where they are less than 3 m horizontally *and less than 2 m above the opening in the exterior wall of the exit.*

EXERCISE #5-4

1. Under what conditions may an unprotected opening in an exposed building face be doubled?

   Glass block conforming to the requirements of Article 3.1.8.14. or wired glass assemblies conforming to the Supplementary Standard SB-2 [3.2.3.12.(1)(a) or (b)].

2. A sprinklered building has windows located in a wall two storeys above the roof of a lower storey (same building). The roof has skylights located 2 m horizontally to the exposed wall.

   Is the building permitted to have skylights as described?

   Yes. The building is sprinklered and as such, the roof of the separate fire compartment is permitted to have skylights within 5 m of the exposed wall [3.2.3.15.(1)].

EXERCISE #5-5

1. A 3 storey office building is constructed with exterior beams and columns (i.e. not heavy timber), supporting the upper two storeys. The columns are located 2.5 m from the property line. The building is constructed in conformance to Article 3.2.2.53. What is the minimum fire protection (fire-resistance rating) required for the exterior structural members?

   1 h minimum fire-resistance rating, irrespective of the floor separation (i.e. the building interior structural members require a 45 min fire-resistance rating if of combustible construction) [3.2.3.9.(2)].

MODULE 6

BUILDING FIRE SAFETY - PART 3

EXERCISE #6-1

1. Is a fire alarm system required for a two storey building where both storeys are classified as Group F, Division 2 industrial occupancy, and the occupant load of each storey is 60 persons?

   a) Yes
   b) No

   b) *No. A fire alarm system is required only if the occupant load of the second floor (medium hazard industrial occupancy) exceeds 75 persons [3.2.4.1.(2)(h)].*

2. Refer to Figure 6-1. A two storey addition is proposed to be constructed to the one storey existing building located at the northwest corner of North Shore Avenue and Sunset Beach Road.

   The addition will be separated from the existing building by a fire separation with a minimum 1 h fire-resistance rating.

   The existing one storey building is a restaurant with an occupant load of 143 persons. The two storeys of the addition will be used for offices. The calculated occupant load of the ground floor addition is 85 persons and the second floor is 90 persons.

   Only building service pipes and electrical wiring in noncombustible raceways penetrate the 1 h fire separation. There are no communicating openings in the 1 h fire separation. Which statement below is correct?

   a) The entire building is required to be provided with a fire alarm system.

   b) Only one suite is required to be equipped with a fire alarm system.

   c) No fire alarm system is required.

   c) *No fire alarm system is required. Each side of the 1 h rated fire separation is permitted by Sentence 3.2.4.2.(4) to be evaluated separately for determining fire alarm requirements.*

Neither side of the 1 h rated fire separation exceeds the criteria in Sentence 3.2.4.1.(2) for requiring a fire alarm system.

EXERCISE #6-2

1. Where a fire alarm system is required, visual alarm signal devices must be provided:

    a) in a compartment referred to in Article 3.3.3.6.,

    b) where ambient noise levels exceed 75 dBA,

    c) in an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA,

    d) in a normally occupied space where the required sound pressure level of the fire alarm audible devices are 10 dBA below the required level.

    c) In an assembly occupancy in which music and other sounds associated with a performance may exceed 100 dBA [3.2.4.19.(8)].

EXERCISE #6-3

1. Under what conditions are annunciator panels not required for fire alarm systems?

    a) A building not more than 6 storeys in building height that does not exceed an aggregate floor area of 2,000 m^2 for all storeys.

    b) A building not more than 3 storeys in building height that has an aggregate area for all storeys of not more than 2,000 m^2.

    c) Where not more than two zones are required.

    b) Refer to Sentence 3.2.4.8.(5)

EXERCISE #6-4

1. Where is a smoke detector required to be used:

   a) in a janitor's room,

   b) in every room in buildings classified as Group A, Division 1,

   c) in every corridor in parts of a building classified as Group A, Division 1 major occupancy.

   c) *Refer to Clause 3.2.4.11.(1)(c)*

2. Sprinklers are permitted by Subsection 3.2.4. in lieu of fire detectors provided:

   e) the sprinkler system is electrically supervised,

   f) the sprinkler system is a wet system,

   g) the building is not subject to the requirements of Subsection 3.2.6.,

   h) the sprinkler system is monitored.

   a) *Refer to Article 3.2.4.15.*

EXERCISE #6-5

1. State below, for each alphabet symbol found on Figure 6-8, the required dimension in compliance with Articles 3.2.5.5. and 3.2.5.6. Identify whether this requirement is 'maximum permitted' or 'minimum required', and the Code references to support your answer.

   a) *minimum 12 m [Clause 3.2.5.6.(1)(b)]*

   b) *not more than 45 m [Clause 3.2.5.5.(2)(c)] and [Sentence 3.2.5.5.(3)]*

   c) *(B) + (C) 90 m maximum [3.2.5.5.(2)(b)]*

   d) *5 m minimum required overhead clearance [3.2.5.6.(1)(c)]*

EXERCISE #6-6

1. Based on Sentence 3.2.5.15.(5), what are the limits for the number of sprinkler heads in a laundry or refuse chute that are permitted to be supplied by the standpipe system?

   There is no limit [3.2.5.15.(5)(a)]

2. There are two combustible refuse storage rooms that are subject to Article 3.6.2.5. Each room is provided with five sprinkler heads. Are the sprinklers from these rooms permitted to be supplied from the standpipe system? Why?

   Yes. A maximum of eight sprinkler heads are permitted for each of the rooms [3.2.5.15.(5)(a)].

EXERCISE #6-7

1. Based on Subsection 3.2.7., what is the minimum required duration for emergency power for lighting in a hospital that is not within the scope of Subsection 3.2.6.?

   a. 1 h
   b. 2 h
   c. 30 min

   a) The building is classified as a Group B major occupancy that is not within the scope of 3.2.6. (high building) [3.2.7.4.(1)(b)(ii)]

2. Which statement below is correct regarding emergency power to provide adequate water supply for firefighting in buildings not regulated under Subsection 3.2.6.?

   a) Emergency power is not required to provide adequate water supply to a standpipe system.
   b) Emergency power is required to provide adequate water supply to a standpipe system.
   c) Emergency power is not required to provide adequate water supply to a sprinkler system.

   a) Standpipe systems are exempt by Sentence 3.2.7.9.(5) from emergency power for a water supply to a standpipe system in a non-high building.

EXERCISE #6-8

1. Which of the following conditions does not apply to an interconnected floor space in an elementary or secondary school?

- a) The interconnected floor space is sprinklered.
- b) The interconnected floor space consists of the first storey, and the storey next above or below it, but not both.
- c) Where a portion of the floor space is not within the interconnected floor space, the required access to exit from this portion of the floor area shall not lead through the interconnected floor space.
- d) The interconnected floor space contains only Group A, Divisions 1, 2, or 3; Group D, Group E, or Group F, Division 3 occupancies.

d) [3.2.8.1.(5)]

2. Which of the following statements do not belong?

Openings for stairways, escalators and inclined moving walks need not conform to the requirements of Articles 3.2.8.3. to 3.2.8.11., provided:

- a) The building is sprinklered throughout.
- b) The interconnected floor space contains only Group A, Divisions 1, 2, or 3, Group D or Group E occupancies.
- c) The opening for each stairway, escalator or walk does not exceed 100 m^2.
- d) The opening for each stairway, escalator or walk does not exceed 10 m^2.

c) [3.2.8.2.(5)]

EXERCISE #6-9

1. Consider a building with a ceiling height of 14 m that is not sprinklered. Which one of the following building areas, occupancy classification and number of storeys will require the installation of a standpipe system?

- a) occupancy classification D, 1 storey, 2,000 m^2
- b) occupancy classification F, Division 3, 2 storey, 1,500 m^2
- c) occupancy classification A, 3 storey, 2,000 m^2
- d) occupancy classification C, 2 storey, 1,000 m^2

c) Refer to Sentence 3.2.9.1.(1)

2. Consider a building that requires a standpipe system and includes a rooftop enclosure. Which one of the following enclosure floor areas requires standpipe coverage?

   a) 5 m^2
   b) 10 m^2
   c) 50 m^2
   d) 55 m^2

   d) Refer to Sentence 3.2.9.1.(5)

EXERCISE #6-10

1. The Code permits the residual water pressure in a standpipe system to be less than 450 kPa under a set of conditions. Which one of the following is a specific part of that set of conditions?

   a) The building is sprinklered.

   b) The system conforms to NFPA 14.

   c) Any dry standpipes are connected to a water supply.

   d) Provision of a fire department connection.

   a) The building is sprinklered [3.2.9.2.(4)(a)]

2. Based on Article 3.2.9.2., a dry standpipe system is:

   a) not permitted,

   b) permitted,

   c) required to be pressurized with nitrogen,

   d) only permitted in sprinklered buildings.

   b) Refer to Sentence 3.2.9.2.(8)

EXERCISE #6-11

1. Consider a building that is 24 m high and requires a standpipe system. Which one of the following conditions meet the requirements of the Code?

a) for a building area of 3,000 m^2, 65 mm connections are required in each storey,

b) for a building area of more than 4,000 m^2, 65 mm connections are required in each storey,

c) for a building area of 4,000 m^2, 45 mm connections are required in each storey,

d) for a building area of 4,310 m^2, 35 mm connections are required in each storey.

b) Refer to Sentence 3.2.9.3.(2)

2. Complete the statement with the correct phrase.

Based on Subsection 3.2.9., hose station cabinets:

a) are required for all occupancies,

b) are not required where tampering may occur,

c) are not required in only high hazard industrial occupancies (Group F, Division 1),

d) are not required in any industrial occupancy.

d) Refer to Sentence 3.2.9.4.(3)

EXERCISE #6-12

1. If a building requiring a standpipe system is 84 m high, what provision is required to conform to the water supply requirements in Subsection 3.2.9.?

a) water flow is permitted to be supplied through the fire department connection,
b) the water supply must be available for 45 min,
c) the building must be served by not less than two sources of water supply from a public water system,
d) supply must be supplemented by a private system.
c) Refer to Sentence 3.2.9.7.(4)

2. A building requires both 38 mm and 65 mm hose connections. Which one of the following water supply flow capacities is the standpipe riser required to be designed to?

a) 1,890 L/min

b) 945 L/min
c) 450 L/min
d) 380 L/min

a) Refer to Clause 3.2.9.7.(1)(a). Although 380 L/min is also required by the 38 mm outlets, the standpipe riser must be designed to the highest flow demand, in this case, 1,890 L/min.

MODULE 7

SAFETY WITHIN FLOOR AREAS

EXERCISE #7-1

1. For the public corridors shown in Figure 7-2 (a) and (b), indicate the rating of the fire separation for the public corridor and the applicable Code reference for the following conditions.

   a) The building is occupied as a business and personal services major occupancy and is regulated by Article 3.2.2.53. The building is not sprinklered. The corridor is 2 m wide (see Figure 7-2 (a)).

   The floor assemblies are required to have a ¾ h FRR by Article 3.2.2.53, and as the building is not sprinklered there is no waiver for the separation of the corridor, therefore a ¾ h fire separation is required [Sentence 3.3.1.4.(2)].

   b) The building is occupied as a mercantile major occupancy and is regulated by Article 3.2.2.60. The corridor is 9 m wide (see Figure 7-2 (b)).

   No separation, as the FRR is waived in a sprinklered floor area where the corridor is 9 m in width, 4 m in height and is not occupied [Sentence 3.3.1.4.(4)(b)].

2. A public corridor in a sprinklered commercial mall is 9 m wide and complies with Sentence 3.3.1.4.(4)(b). What is the fire separation requirement between the tenant spaces that are occupied as business and personal service or mercantile occupancies.

   No suite fire separations required by Sentence 3.3.1.1.(3)

3. In a sprinklered high-rise apartment building, what is the fire separation requirement between the public corridor and the dwelling units?

   ¾ h, as the waiver of the rating for sprinklered floor areas does not apply to residential *occupancies [Sentences 3.3.1.4.(2) and 3.3.1.4.(3)].*

4. A public corridor serves a dwelling unit and four offices on the second floor of a two storey sprinklered commercial building. Each tenant space has 200 m^2. The building is regulated by Articles 3.2.2.56 and 3.2.2.46. What fire separation is required for the public corridor?

   ¾ h, governed by the residential occupancy floor separation required by Article 3.2.2.6 for the most restrictive occupancy [3.3.1.4.(2)].

Exercise #7-2

1. What fire separation is required between a storage room within a dwelling unit and an adjacent bedroom?

   No separation is required. Sentence 3.3.4.3.(2) only applies to storage rooms not within a suite.

2. What fire separation is required between a chemistry lab in a sprinklered secondary school and a corridor used by the public?

   30 min in accordance with Sentence 3.3.2.2.(4)

3. What fire separation is required between a parking garage and an adjacent garbage room in an apartment building?

   1 ½ h in accordance with Sentence 3.3.5.6.(1)

4. What fire separation is required between a multi-purpose room in a sprinklered secondary school and a corridor used by the public, if the occupant load in the room is greater than 200 persons?

   30 min, Clause 3.3.2.2.(8)(b) applies even if the corridor is not required to have a fire-resistance rating due to the building being sprinklered.

EXERCISE #7-3

1. An office suite in a Group D sprinklered building has an area of 280 m^2. The travel distance from a remote point in the suite has a travel distance of 30 m to the public corridor entrance to the suite. A single egress door is permitted from this suite. True or false? Explain

   False. Travel distance is greater than 25 m [3.3.1.5.(1)(d)(i)]

2. A mechanical penthouse on the roof of a sprinklered building has an area of 200 m^2. A single exit stair may provide the only access to the penthouse if the travel distance from any point in the penthouse to the exit door does not exceed 50 m as permitted by Sentence 3.4.2.4.(3). True or False? Explain.

   False. The travel distance for a single egress point is 25 m according to Sentence 3.3.1.3.(7)

3. A mezzanine in a Group F2 occupancy is not required to terminate at a vertical fire separation by Subsection 3.2.8 and has an area of 200 m^2 in a sprinklered floor area. The travel distance from any point on the mezzanine to the top of the stair providing egress from the mezzanine is 25 m. The suite in which the mezzanine is located has an area of 600 m^2. The single stair serving the mezzanine is acceptable. True or False? Explain.

   True. The room in which the mezzanine is located would require two means of egress. Therefore, Clause 3.3.1.5.(3)(b) would apply.

4. How many egress doors are required from a hazardous classroom in a sprinklered secondary school if the classroom has an area of 150 m^2 and the room measures 10 m by 15 m.

   Two egress doors, as the area is greater than 100 m^2 as per Clause 3.3.1.5.(1)(e)]

5. In a sprinklered office building, a tenant has a suite with an area of 320 m^2 and has two egress doorways. What is the maximum travel distance from any point in the suite to the nearest egress doorway?

   [45 m, as per Sentence 3.3.1.6.(1), & 3.4.2.5.(1)(c)]

EXERCISE #7-4

1. A classroom in a secondary school has a total occupant load of 60 persons. The room has a single egress door. The door may swing into the classroom. True or False?

   True, the occupant load is not more than 60 persons as permitted by Sentence 3.3.1.10.(2)

2. A classroom in a school is located in a dead-end corridor. The occupant load in the classroom is not more than 60 persons. Under what conditions is this egress arrangement permissible?

When there is a second and separate door from the room that does not open into a dead-end corridor [Sentence 3.3.1.9.(8)]

3. What is the minimum clear opening width of a doorway serving a meeting room in a school? The room has a single means of egress and can accommodate up to 30 persons.

   The general requirement from Clause 3.3.1.12.(1)(a) is 800 mm, but the room must be barrier-free accessible, therefore the minimum clear width is 850 mm [Sentence 3.8.3.3.(1)]

4. A client wishes to install an electromagnetic locking device (EMLD) on a door to a computer room in an office building. The room is permitted to have a single egress door and will have an occupant load of 15 persons. The EMLD will be installed in accordance with Sentence 3.4.6.15.(4) and may be unlocked by the activation of a pull station located on the room side of the door. Is this locking device permitted, or does it contravene Sentences 3.3.1.12.(2) and (3)?

   It is permitted by Sentence 3.3.1.12.(10)

5. A dead-end corridor serves two Group F2 industrial tenants on the ground floor of a 6 storey sprinklered building. Each tenant space has an exit door that opens directly to the exterior. The corridor is separated from each tenant space by a 1 h fire separation. Is there a maximum length for this corridor to serve as a second means of egress?

   Yes, 45 m. Although there is no maximum length specified for a dead-end corridor when there is a second egress door from a suite [3.3.1.9.(13)], the maximum travel distance from any point in a floor area in a sprinklered building is 45 m [3.4.2.4.(2) and 3.4.2.5.(1)].

6. What is the minimum height of a guard at the foot of a stepped aisle serving a balcony in a theatre?

   920 mm, as per Subclause 3.3.2.8.(1)(a)(ii)

EXERCISE #7-5

1. What is the minimum size of a balcony in a 3 bedroom dwelling unit for compliance as an area of refuge under Article 3.3.1.7. for protection of floor areas in a barrier-free path of travel?

1500 mm deep with an area of not less than .5 m^2 for each occupant and a 13 mm "curb", as per Clauses 3.3.1.7.(7)(b) and (c). Note that the Code requires two persons per bedroom by 3.1.17.1.(1)(b).
Area = 0.5 x 3 x2 = 3.0 m^2

2. What is the minimum height of a guard in the front of seats in the balcony of a theatre?

   760 mm, according to Subclause 3.3.2.8.(1)(a)(i)]

3. What is the maximum length of a dead-end aisle in a classroom with fixed seats if the classroom is not separated from adjacent classrooms or the corridor used by the public?

   6 m, as per Sentence 3.3.2.4.(12)

4. What fire separation is required between a kitchen and a servery in a sprinklered secondary school cafeteria with seating for 250 students?

   30 minutes as per Sentences3.3.2.2.(8) and (9)

5. Consider a three storey building of residential occupancy. Two dwelling units on each of the 2nd and 3rd floors exit directly into the exit stair shaft. If each dwelling unit has access to another access to exit, is this permitted?

   Yes, see Sentence 3.3.4.4.(6)

6. What row spacing is required in a theatre that has two aisles with 30 seats between the aisles?

   a) 400 mm
   b) 485.4 mm
   c) 497.6 mm
   d) 583 mm

   b) 30 - 16 = 14 seats over 16
   extra width required = 14 x 6.1 = 85.4 mm
   row spacing is 400 + 85.4 = 485.4 mm
   [Subclause 3.3.2.3.(5)(c)]

7. A lecture hall in a university building has theatre type seating on stepped rows. What height above the back row of seating must the ceiling be, if the dead-end aisle serving the row is 10 m long?

   3 m high ceiling above back row [3.3.2.4.(13)(e)]

8. The riser of a step in an aisle in an assembly occupancy may be not less than 125 mm high. True or False?

   False, the minimum height of a riser is 110 mm high [Sentence 3.3.2.4.(21)]

MODULE 8

EXITS

EXERCISE #8-1

1. The cumulative capacity of two converging exits serving a floor area cannot exceed . . .

   50% of the total required width [3.4.1.2.(2)]

2. Which of the following is not considered an exit?

   a) interior stairway
   b) elevator
   c) exterior ramp
   d) exterior doorway
   e) interior passageway

   b) *elevator is not an exit, [3.4.1.4.(1)]*

3. Exterior exit passageways may be accessed through operable exterior windows. True or false?

   False, access must be through a door at floor level [3.4.1.5.(1)]

4. Why must exits be kept separate from one another when more than one exit is required?

   To provide another means of escape in case one exit cannot be utilized in a fire condition.

5. Summarize the general requirements for glass doors in an exit.

   a) *Must be laminated or tempered safety glass conforming to CAN/CGSB 12.1-M, or wired glass conforming to CAN/CGSB 12.11-M [3.4.1.8.(1) & 3.3.1.18.(2)].*

   b) *Must be readily apparent with nontransparent hardware, bars or other permanent* *fixtures [3.4.1.8. & 3.3.1.18.(1)].*

EXERCISE #8-2

Read Articles 3.4.2.1. and 3.4.2.3. and answer the questions that follow.

1. The floor area of an office building is not subdivided by a fire separation or provided with a public corridor. The maximum diagonal dimension of the floor area is 54 m. What is the required minimum exit separation distance?

   50% of 54 m = 27 m [3.4.2.3.(1)(b)]

2. A residential apartment building floor area is constructed with multiple dwelling units served by a public corridor with exits at either end. The maximum diagonal dimension of the floor area is 38 m. What is the required minimum exit separation distance?

   9 m [3.4.2.3.(1)(a)]

3. Consider a two storey unsprinklered retail building having a building area of 170 m^2. One exit serves both the first and second floors. The occupant load is 46 persons on the first floor and 30 persons on the second floor. Maximum travel distance to an exit is 22 m. Does the Code permit a single exit from the building? Explain.

   No, at least two exits are required. Occupant load served by the exit = 46 + 30 = 76 > 60 persons, [3.4.2.1.(2)]

EXERCISE #8-3

1. Travel distance may be measured from an egress door of a room or suite to the nearest exit in specific circumstances. Which of the following conditions does not allow travel distance measurement from a room or suite egress door?

   a) When the room or suite is served by an exterior passageway.
   b) When the room or suite is served by a public corridor that is separated from the remainder of the floor area by a fire separation
   c) When the room or suite is served by a corridor used by the public that is separated from the remainder of the floor area by a fire separation.
   d) When the room or suite is not separated from the remainder of the floor area by a fire separation.

   d) [3.4.2.4.(2)(a)]

2. Identify the maximum travel distances permitted in the following circumstances:

   a) business occupancy, unsprinklered

      40 m, [3.4.2.5.(1)(b)]

   b) residential occupancy, unsprinklered

      30 m, [3.4.2.5.(1)(f)]

   c) retail occupancy, sprinklered

      45 m, [3.4.2.5.(1)(c)]

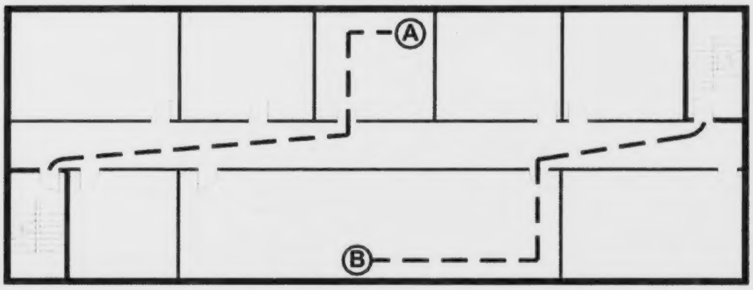
3. Describe a condition under which the location of an exit is permitted to be sealed.

   Not permitted. Exits must be located and arranged so that they are clearly visible, or their locations are clearly indicated and they are accessible at all times. [3.4.2.5.(3)]

4. Using Figure 8-3, determine the maximum travel distances permitted from identified locations A and B to the nearest exit as shown on the drawing.

Maximum Travel Distances

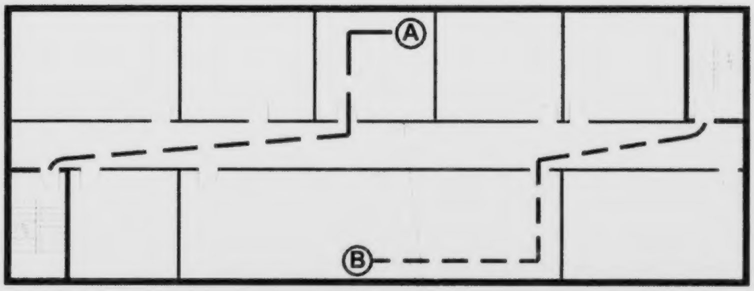
DRAWING 8-3: EXERCISE No : 3



3rd Storey Of Unsprinklered Office Building

A: Suite requiring 1 egress doorway 40 m [3.4.2.5.1(1)(b)]

B: Suite requiring 2 egress doorway 40 m [3.4.2.5.1(1)(b)]



3rd Storey Of Sprinklered Office Building

A: Suite requiring 1 egress doorway 45 + 25 = 70m [3.4.2.5.(1)(c) + 3.3.1.5(1)(d)]

B: Suite requiring 2 egress doorway 45 + 45 = 90m [3.4.2.5.(1)(c) + 3.3.1.6]

FIGURE 8-3

EXERCISE #8-4

Read Subsection 3.4.3. and answer the following questions.

1. Refer to Figure 8-4. If the required width of the exit doorway is 790 mm, and 1100 mm for the stair, determine the minimum clear unobstructed width(s) for the following:

   d. Doorway A

   790 - 50 = 740 mm, [3.4.3.4.(2)]

   b) Landing at B

   750 mm, [3.4.3.4.(3)]

   c) Stair C

   1100 - (2 x100) = 900 mm, [3.4.3.4.(4)]

2. The second storey of a cinema complex contains 8 theatres with a total occupant load of 1,350 persons.

   a) If the floor area is served by 2 exits, calculate the minimum required width of the exit doorways to each exit stair.

   1,350/2 = 675 persons/exit, [3.4.3.2.(6)]

   675 x 6.1 mm/person = 4,118 mm, [3.4.3.2.(1)(a)]

EXERCISE #8-5

1. Determine the fire-resistance rating required for an exit stair shaft in a storey where the floor assembly above the storey has the following fire-resistance rating:

Floor Assembly Fire-resistance Rating	Exit Fire-resistance Rating	OBC reference
0 h (unrated fire separation)	*45 min*	*[3.4.4.1.(1)]*
1 h	*1 h*	*[3.4.4.1.(1)]*
2 h	*2 h*	*[3.4.4.1.(1)]*
3 h	*2 h*	*[3.4.4.1.(2)]*

2. The integrity of exit enclosures is important. List the openings that are permitted in a fire separation that separates an exit from the remainder of the building.

   - *standpipe and sprinkler piping [3.4.4.4.(1)(a)]*
   - *wiring in noncombustible conduit and noncombustible piping that serves only the exit [3.4.4.4.(1)(b)]*
   - *openings for compliance with Subsection 3.2.6. [3.4.4.4.(1)(c)]*
   - *exit doorways [3.4.4.4.(1)(d)]*
   - *wired glass and glass block complying with Article 3.1.8.14. [3.4.4.4.(1)(e)]*

3. Service and ancillary rooms such as storage rooms, washrooms, toilet rooms, and laundry rooms cannot open directly into an exit. Imagine that there is no alternative: what must be located between such rooms and the exit?

   A vestibule [3.4.4.4.(7)]

4. Exiting from the second storey of a motel is provided by an exterior passageway. Describe conditions under which the exterior passageway will not be required to be separated with a fire separation from the remainder of the building.

   - *minimum 50% of the exterior side is open to the outdoors [3.4.4.3.(1)(a)], and*

- *an exit stair is provided at each end of the passageway [3.4.4.3.(1)(b)]*

5. Answer the following questions using the floor plan in Figure 8-6.

   a) What is the maximum length of travel (A) through the lobby?

   15 m, [3.4.4.2.(1)(b)]

   b) Identify uses of suite B that are not permitted to open into the exit lobby.

   - *residential or industrial occupancies, [3.4.4.2.(2)(c)]*
   - *service and storage rooms, [3.4.4.2.(2)(e)(i)]*
   - *service spaces, [3.4.4.4.(9)]*
   - *washrooms, toilet rooms, laundry rooms and similar ancillary rooms, [3.4.4.4.(8)]*

   d) Is door C required as shown on the drawing, or can it be removed?

   Required, [3.4.4.2.(2)(f)]

   d) Is partition D required to be a fire separation?

   Yes, [3.4.4.2.(2)(e)]

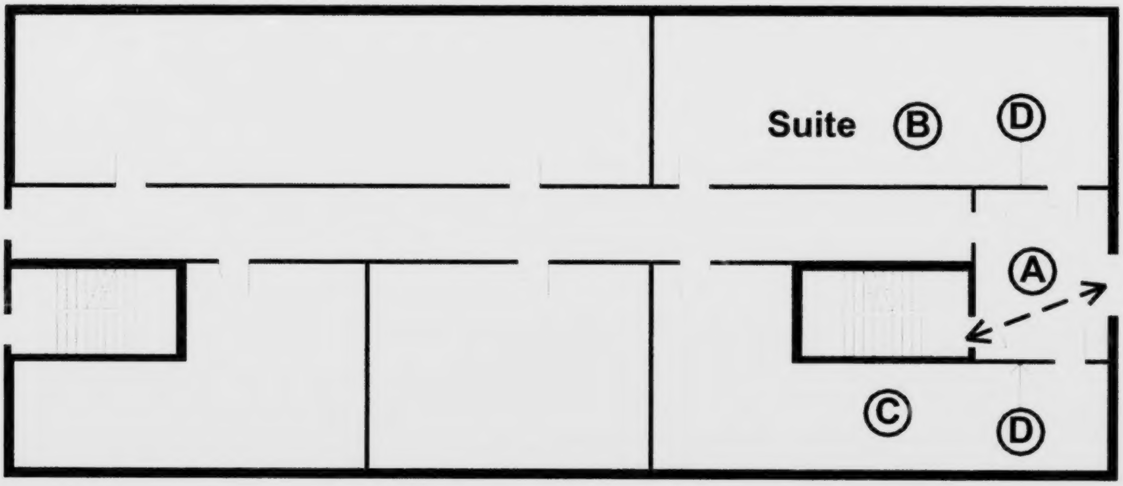
   e) What fire-resistance rating is required for partition D if:

   i) the floor area is unsprinklered?

   Equal to exit stair fire-resistance rating, [3.4.4.2.(2)(e)]

   ii) the floor area is sprinklered?

   Unrated fire separation, [3.4.4.2.(2)(e)(iii)]



UNSPRINKLERED BUILDING

FIGURE 8-6

6. Are passenger elevators permitted to open onto an exit lobby? If so, under what condition(s) is it permitted?

   Yes, provided the elevator entrance doors are designed to remain closed while loading and unloading [3.4.4.2.(2)(e)(iv)].

EXERCISE #8-6

1. Openings requiring protection under this Article may be protected by one of the following:

   - *glass block conforming to Article 3.1.8.14., [3.2.3.13.(4)(a)]*
   - *wired glass complying with the Supplementary Standard SB-2, [3.2.3.13.(4)(b)]*
   - *closures conforming to Subsection 3.1.8., Articles 3.2.3.1., and 3.2.3.14., [3.2.3.13.(4)(c)]*

2. In accordance with Sentence 3.2.3.13.(1), openings in the exterior wall of an exit must be protected from openings in the wall of the building by protecting either the exit wall openings or the building wall openings if the walls are exposed at an angle of

   less than 135°, and are within 3 m horizontally,

   or less than 10 m below the exit opening,

   or less than 2 m above the opening.

3. Is it permitted to install a door with a fire protection rating in the exterior doorway from an exit stair shaft if the doorway is located within 3 m of an unprotected window in an adjacent floor area? Explain.

   No. Sentence 3.2.3.13.(3) requires the opening in the floor area wall to be protected. This is because stair occupants could otherwise be exposed to fire from an unprotected opening of the floor area after exiting the stair enclosure.

EXERCISE #8-7

1. Which of the following exit sign colour schemes are permitted?

a) Red letters on contrasting background

Yes, [3.4.5.1.(3)]

b) Green background with contrasting letters

No, [3.4.5.1.(3)]

c) Red background with contrasting letters

Yes, [3.4.5.1.(3)]

d) Green letters with contrasting background

No, [3.4.5.1.(3)]

2. Identify requirements for letter size on exit signs.

a) internally illuminated

i) height	*114 mm, [3.4.5.1.(3)(a)]*
ii) stroke	*19 mm, [3.4.5.1.(3)]*

b) externally illuminated

i) height	*150 mm, [3.4.5.1.(3)(b)]*
ii) stroke	*19 mm, [3.4.5.1.(3)]*

3. Explain the purpose of exit signs required by Article 3.4.5.2.

To clearly identify the direction of exit travel and the location of exits from the building to prevent unnecessary delay in exiting.

EXERCISE #8-8

1. Figure 8-7 illustrates an exit stair with a required width of 1200 mm based on occupant load. Complete the dimensions in the following table:

ANSWERS TO EXERCISE QUESTIONS

Drawing Reference	Subject	Code Reference	Code Requirement
A	Landing width	3.4.6.3.(2)	1200 mm
B	Handrail extension at top	3.4.6.4.(7)	300 mm
C	Handrail extension at bottom	3.4.6.4.(7)	300 mm plus tread depth
D	Clearance of stair riser to leading edge of door	3.4.6.10.(1)	300 mm
E	Height of riser	3.4.6.7.(2)	200 mm max. 125 mm min.
F	Run	3.4.6.7.(1)	255 mm min. 355 mm max.
G	Maximum vertical rise of stair flight	3.4.6.3.(1)	3.7 m max. except for Group B, Division 2 or 3

Exit Stair

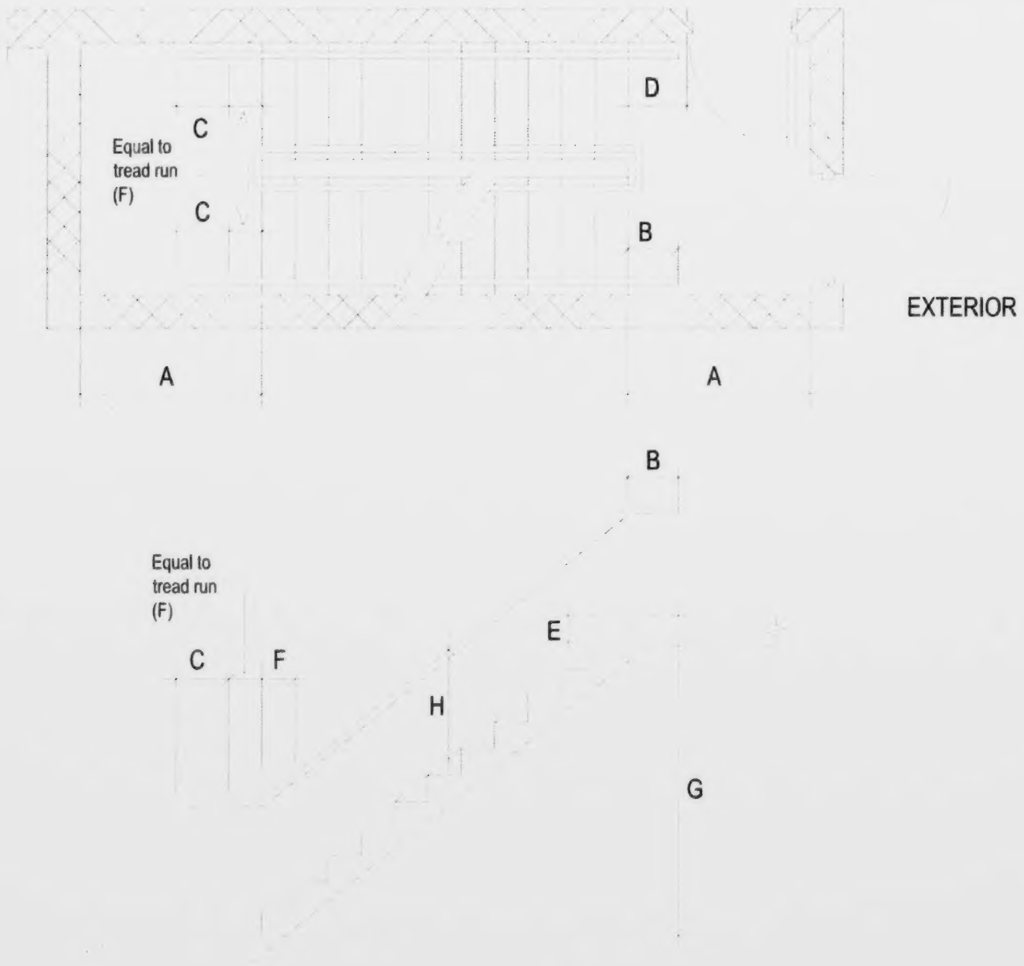

D
C
Equal to tread run (F)
C
B
EXTERIOR
A
A
B
Equal to tread run (F)
E
C
F
H
G

FIGURE 8-7

2. Except for food and beverage establishments, Article 3.4.6.2. requires interior stairs to have at least 3 risers. Article 3.4.6.7. requires each riser to have a minimum 125 mm height. Suggest a design solution to accommodate a change in exit floor elevation of only 250 mm.

   Provide a ramp, [3.4.1.4.(1)(h), 3.4.6.6.(1)]

3. Complete the following table to summarize the maximum slope of ramps used as exits.

Major Occupancy or Application	Maximum Slope *	Code Reference
Assembly Care or detention Residential	1:10	3.4.6.6.(1)(a)
Mercantile Industrial	1:6	3.4.6.6.(1)(b)
Other	1:8	3.4.6.6.(1)(c)
Exterior	1:10	3.4.6.6.(1)(d)

* Note: In a barrier-free path of travel, ramp slope is limited to 1:12 [3.8.3.4.]

4. Select the correct maximum slope for an exterior ramp at exit doors from a retail mall.

   a) 1:6
   b) 1:8
   c) 1:10
   d) 1:12

   c) 1:10, [3.4.6.6.(d)]

EXERCISE #8-9

ANSWERS TO EXERCISE QUESTIONS

1. Identify the condition where an exit door, swinging on its vertical axis, is permitted to open in a direction opposite to the direction of exit travel.

	Yes	No
a) Serving a single dwelling unit [3.4.6.11.(2)]	X	
b) Where the door may be in danger of blockage from ice or snow [3.4.6.10.(2)]		X
c) Serving a room, suite or floor area having an occupant load not greater than 60 persons (excluding F-1major occupancies) [3.4.6.11.(3)(a)]	X	
d) Serving multiple floor areas having a total occupant load not greater than 60 persons (excluding F-1 major occupancies) [3.4.6.11.(3)(b)]	X	

2. Identify which of the following exit doors require release hardware operated with the application of a 90 N force to the hardware in the direction of exit travel.

   a) exit door serving a floor area of high hazard industrial major occupancy with an occupant load of 40 persons

   Yes, based on major occupancy [3.4.6.15.(2)(c)]

   b) exit door serving a restaurant with an occupant load of 130 persons

   Yes, based on occupant load in excess of 100 persons, [3.4.6.15.(2)(a)]

   c) exit door to the exterior from an exit stair serving a 4 storey apartment building with an occupant load of 92 persons

   No, based on occupant load not exceeding 100 persons [3.4.6.15.(2)(b)]

3. It was previously noted in Clause 3.4.3.2.(7)(g) that the minimum width of an exit door is 790 mm. However, Sentence 3.4.6.10.(4) permits a minimum door leaf width of 600 mm provided:

   More than 1 leaf is installed in the doorway. The minimum width of such a doorway is therefore 1200 mm (2 x 600 mm).

MODULE 9

VERTICAL TRANSPORTATION SERVICE FACILITIES ANCHORAGE FOR FIXED ACCESS LADDERS

EXERCISE #9-1

1. What is the minimum fire-resistance rating for a vertical service space used as an elevator hoistway in a building where the floor assemblies are required to be fire separations having a 1 h fire-resistance rating?

   1 h [Table 3.5.3.1]

2. Except for the elevator hoistway, elevator machine rooms are required to be separated from all other parts of the building with the exception of the hoistway by a fire separation having a fire-resistance rating not less than that required of the vertical service space containing the elevator hoistway. True or false?

   True [3.5.3.3.(1)]

3. An elevator car used to conform to the requirements of Article 3.3.1.7. must be large enough to accommodate what size of stretcher?

   Must be able to accommodate a stretcher 2010 mm x 610 mm [3.5.4.1.(1)]

EXERCISE #9-2

1. What is the minimum required fire-resistance rating for a room containing a fuel-fired appliance that serves more than one suite in a three storey building of Group A occupancy?

   1 h [3.6.2.1.(1)]

2. Is a boiler operating in excess of 100 kPa permitted in a room located under an exit?

   No [3.6.2.2.(1)]

3. What is the required fire-resistance rating of a sprinklered combustible refuse storage room in which a refuse chute does not discharge?

   1 h [3.6.2.5.(1)]

EXERCISE #9-3

1. List five required properties of a linen chute.

   (1) Impervious to moisture, (2) smooth internal surface, (3) corrosion-resistant, (4) noncombustible, (5) no other services in shaft, (6) have a fire-resistance rating, (7) interior linen chutes shall extend above the roof and be vented, (8) shall be sprinklered [3.6.3.3.(1), (2), (3), (4), (5), and (6)].

2. How would you terminate a vertical service space that does not extend through the roof of a building?

   Shall be enclosed at the top with construction that has a fire-resistance rating not less than that of the vertical service space walls [3.6.3.1.(2)].

3. What is the required fire-resistance rating for the fire separation of a vertical service space in a building required to have 2 h floor assemblies?

   1.5 h for elevator shafts [Table 3.5.3.1] and 1 h for all other shafts [Table 3.6.3.1]

EXERCISE #9-4

1. What is the maximum flame-spread rating and smoke developed classification for materials in a plenum in a floor assembly?

   25 flame-spread rating, 50 smoke developed classification [3.6.4.3.(1)(a)]

2. What is the minimum size of access opening required for a crawl space?

   Not less than 550 mm by 900 mm [3.6.4.6.(1)]

3. In a ceiling plenum that incorporates a firestop flap, which test must the flap conform to?

   CAN4-S112.2-M, Fire Test of Ceiling Firestop Flap Assemblies" [3.6.4.3.(2)(c)]

EXERCISE #9-5

1. What is the minimum design live load between two consecutive attachments in a fixed ladder?

1.1 KN between two consecutive attachments [SB-8]

2. What type of anchor should be avoided when fastening a ladder onto a masonry wall?

   Expansion anchors [SB-8]

3. What should be done to provide an improved margin of safety for fixed access ladders?

   Two means of anchoring the top of the ladder [SB-8]

MODULE 10

HEALTH REQUIREMENTS

EXERCISE #10-1

1. What is the minimum size of a second bedroom in a dwelling unit that does not have built-in cabinets?

   7 m^2 [9.5.7.1(1) and 3.7.1.2.(1)]

2. In a recreational camp what is the minimum area per person (camper) of a single sleeping quarters without single beds?

   3.72 m^2 [3.7.1.4.(1)]

EXERCISE#10-2

1. What is the minimum window size for a kitchen in a residential dwelling with electric lighting?

   Windows not required [9.7.1.2(1) and Table 9.7.1.2]

2. What is the minimum height of a guard for a fixed window in a dwelling unit that is less than 1000 mm above the floor, if there is no balcony and the dwelling unit is located in an apartment building?

   1000 mm [3.7.2.2(2)]

3. What is necessary to protect a window in a dwelling unit that opens 2100 mm above

grade and less than 1500 mm above the floor?

A guard, or controlled sash, and heavy duty screen or alternative device [3.7.2.2.(3)]

4. What Standard regulates the requirements for a heavy duty screen in the operable portion of a controlled sash?

   CAN/CSA-A440 [3.7.2.2(3)(b)(ii)]

EXERCISE #10-3

1. Calculate the minimum number of water closets required for a 1000 m^2 Group D occupancy office building.

   1000 m^2/14 m^2 per person = 72 persons or 36 persons of each sex [3.7.4.2.(1) and (2)]

   Table 3.7.4.7, three water closets for each sex are required [3.7.4.7.(1)]

2. Calculate the minimum number of lavatories required for a washroom required to have five water closets.

   5 – 2 = 3 (one lavatory)

   $\frac{3}{2}$ = 1.5 (additional lavatories)
   ∴ 3 lavatories are required [3.7.4.2.(5)]

3. If five water closets are required in a male washroom of an office building, how many of these water closets are permitted to be urinals?

   $\frac{2}{3} \times 5$ = 3.33 (3 urinals)

   3 urinals [3.7.4.2.(3)(b)]

4. How many male and female water closets are required for an elementary school of 500 persons?

   500/2 = 250 persons of each sex [3.7.4.2.(2)]

   250/30 males = 8.33, provide 9 male water closets [3.7.4.3.(14)]

   250/26 = 9.62, provide 10 female water closets [3.7.4.3.(14)]

EXERCISE #10-4

1. In a cafeteria, what type of floor covering is required in the food preparation area?

   Tight, smooth and non-absorbent [3.7.6.2.(1)]

2. Under what condition is a washroom for a restaurant permitted to be located outside the restaurant?

   If it is in the same building as the restaurant and within 45 m [3.7.6.3.(3)(a) and (b)]

MODULE 11

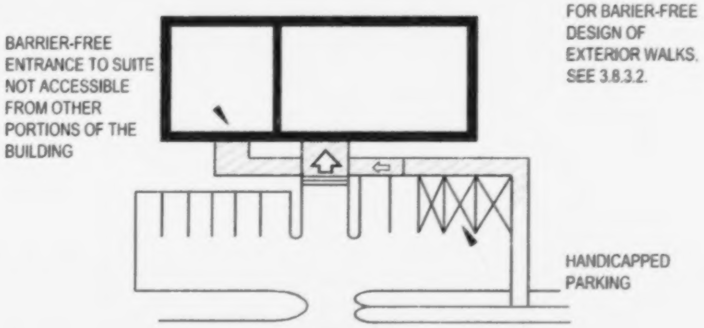
BARRIER-FREE DESIGN

EXERCISE #11-1

1. Which of the following types of buildings will require barrier-free design?
   a) high hazard industrial occupancies
   b) boarding and rooming houses serving 8 people or more
   c) buildings occupied on a part-time basis such as pump houses and substations
   d) houses, including townhouses and row houses

   b) Boarding or rooming houses serving 8 people or more [3.8.1.1.(1)(a)].

2. What is the total number of pedestrian entrances required to be barrier-free in a building that contains a total of (5) five entrances, where (4) four of the entrances serve mercantile occupancies, and (1) one entrance serves an assembly occupancy which is completely separated from the remainder of the building (i.e. assembly occupancy is not accessible via entrances serving mercantile occupancies)? Refer to Figure 11-1.


BARRIER-FREE ENTRANCE TO SUITE NOT ACCESSIBLE FROM OTHER PORTIONS OF THE BUILDING
FOR BARIER-FREE DESIGN OF EXTERIOR WALKS. SEE 3.8.3.2.
HANDICAPPED PARKING

Suites of assembly occupancy, office or retail use on the first storey or other barrier-free accessible floor levels, and which are not accessible from the remainder of the building, require individual barrier-free entrances.

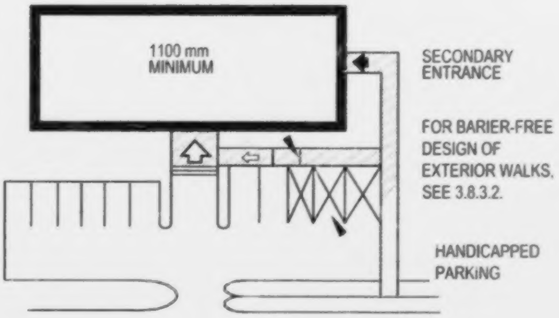

1100 mm MINIMUM
SECONDARY ENTRANCE
FOR BARIER-FREE DESIGN OF EXTERIOR WALKS, SEE 3.8.3.2.
HANDICAPPED PARKING

FIGURE 11-1

Three barrier-free entrances are required. The mercantile occupancy requires two barrier-free entrances. The assembly occupancy requires one barrier-free entrance because there is no other access from the mercantile occupancy [3.8.1.2.(2) and Table 3.8.1.2].

3. If at a required barrier-free entrance there are six exterior doors, all doors are required to be designed in accordance with Section 3.8. True or false?

   False. Only one of the doors in a barrier-free entrance that includes more than one doorway is required to meet requirements of Article 3.8.3.3. and Sentence 3.8.1.2.(4).

4. A barrier-free path of travel is provided with the minimum width permitted under Sentence 3.8.1.3.(1) and has a length of 31 m. What provisions are required for a wheelchair?

   An unobstructed space not less than 1600 mm x 1600 mm located not more than 30 m apart [3.8.1.3.(4)].

5. Summarize the general requirements for a barrier-free path of travel with respect to walking surfaces, building controls and illumination. With respect to illumination, identify the Code reference that outlines the specific requirements.

   Surfaces: Openings not greater than 13 mm and perpendicular to direction of travel. Surface to be stable and slip resistant. Bevelled slope of 1 in 2 for changes in level that are not greater than 13 mm. Sloped floors or ramps are required for changes in a level more than 13 mm [3.8.1.3.(2)] .

   Controls: Controls intended to be operated by the occupant are to be mounted at a maximum height of 1200 mm above the floor [3.8.1.5.].

   Illumination: In accordance with lighting requirements of Sentence 3.2.7.1.(1) [3.8.1.6.].

EXERCISE #11-2

1. The provision of a barrier-free path of travel for residential occupancies applies to which of the following:

   a) into suites that are located in storeys above the entrance storey and not served by an elevator
   b) into suites served by an elevator
   c) within all portions of suites served by an elevator
   d) egress from suites served by an elevator

b) *A barrier-free path of travel is required to the entrance of a suite served by an elevator [3.8.2.1.(2)(j)].*

2. When is a balcony in a dwelling suite required to be barrier-free accessible? (Hint: Review requirements of Article 3.3.1.7.).

   Balconies are required to be used as an area of refuge where no elevator meeting the high-rise requirements is provided for the rescue of persons requiring assistance, and where the barrier-free path of travel is not divided into at least two zones by a fire separation [3.3.1.7.(2)].

3. A six storey parking garage with an office tower located above, is constructed and provided with a common elevator shaft. The third floor parking level is designated with parking spaces for wheelchair accessible vehicles.

   a) List the applicable Code references for the components below located in a barrier-free path of travel accessing the parking garage.

      i) building entrance
      ii) vehicle entrance and designated parking space
      iii) elevator shaft serving parking garage and office tower

      i) Sentence 3.8.2.2.(1)
      ii) Sentence 3.8.2.2.(2)
      iii) Clause 3.8.2.2.(1)(b)

   b) Based on your analysis, which storeys in the parking garage are not required to be provided with the clearance for a wheelchair accessible vehicle?

      Storeys 4, 5 and 6 of the parking garage are not required to be provided with clearance for a wheelchair accessible vehicle, unless the wheelchair accessible vehicle must travel through these floors to egress the parking garage]3.8.2.2.(2)].

   See Figure 11-2.

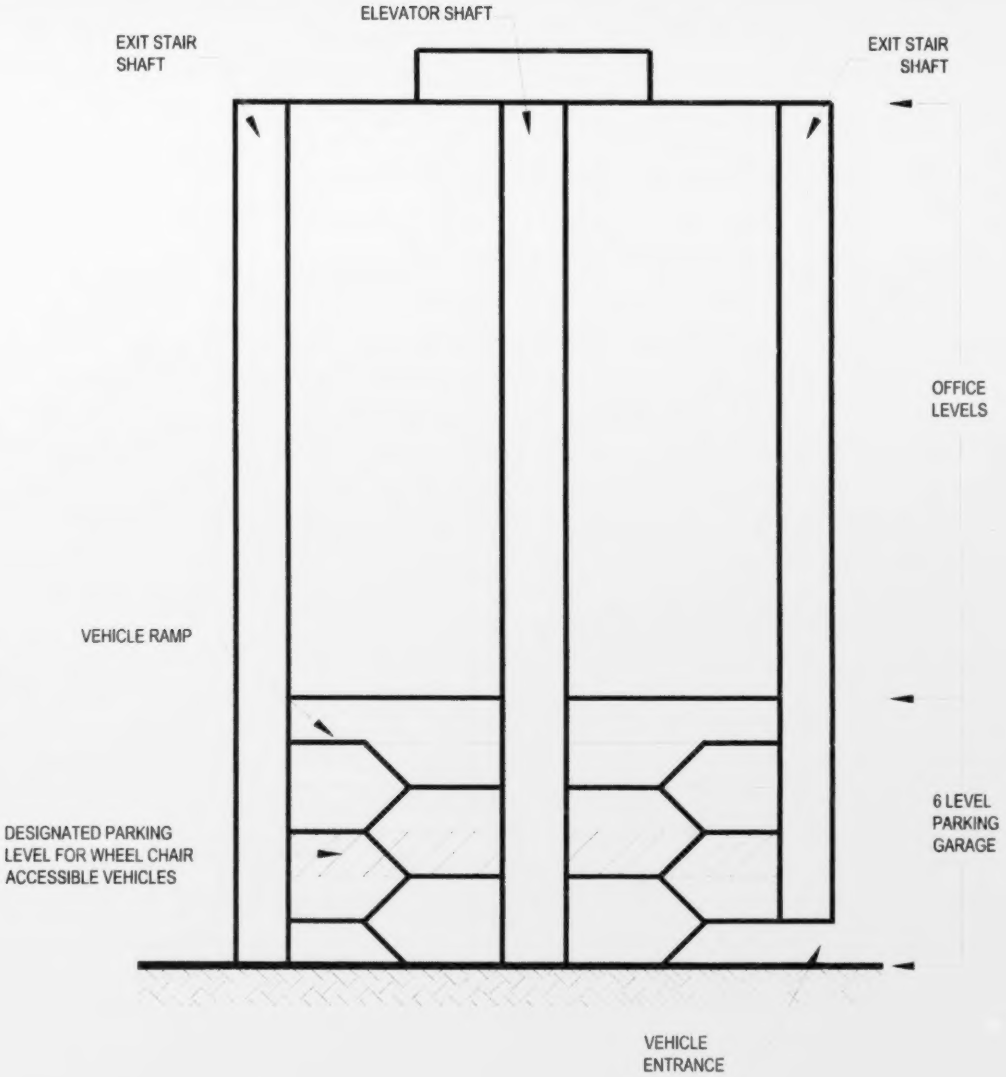

ELEVATOR SHAFT
EXIT STAIR SHAFT
EXIT STAIR SHAFT
OFFICE LEVELS
VEHICLE RAMP
6 LEVEL PARKING GARAGE
DESIGNATED PARKING LEVEL FOR WHEEL CHAIR ACCESSIBLE VEHICLES
VEHICLE ENTRANCE

FIGURE 11-2

4. Consider a shopping mall with a public corridor and a food court area with public washrooms located within 45 m of the food court area. What are two possible options to meet the barrier-free washroom requirements?

   Possible options:

   a) *provide barrier-free stalls in the public washrooms serving the food court area [3.8.2.3.(2)].*
   b) *provide separate barrier-free washrooms within 45 m of food court washrooms [3.8.2.3.(1)].*

5. Consider a strip mall with individual mercantile suites. Which mercantile suites do not require a barrier-free washroom?

   Suites which have an area less than 300 m^2, provided that the mall is served with public washrooms that are designed to accommodate disabled persons in conformance with Articles 3.8.3.8. to 3.8.3.12. [3.8.2.3.(1) and (3)].

EXERCISE #11-3

1. What is the minimum height required for an exterior walk to be considered free of obstructions?

   1980 mm [3.8.3.2.(1)(f)]

2. What is the minimum clear width of a door serving a bathroom in a barrier-free path of travel in a residential occupancy? How does the corridor width affect the door width?

   760 mm door width if served by a corridor not less than 1060 mm in width, and 810 mm clear width if served by a corridor less than 1060 in width [3.8.3.3.(2)].

3. What is the latch side clearance of a bathroom door located in a residential suite that swings towards the approach side? Explain.

   600 mm, unless provided with a power door operator. Only applicable to doors equipped with self-closing devices [3.8.3.3.(10)].

4. Describe the provisions necessary for guards serving ramps so as not to facilitate climbing.

Designed so that no part of guard is located between 140 mm and 900 mm above the ramp surface that will facilitate climbing [3.8.3.4.(1)(f)(ii)].

5. There are four designated spaces in a seating area serving 250 people. Each designated space is accessible at the same floor level as the points of entry into the assembly space. What specifically is excluded from the barrier-free path of travel within the seating area?

   All aisles and portions of seating area serving only fixed seating [3.8.3.6.].

   See Figure 11-6.

6. What is the minimum clearance within a barrier-free water closet stall that will permit the stall door to swing into the stall?

   760 mm x 1220 mm clear floor area provided within the stall [3.8.3.8.(1)(b)(iii)]

7. Under what design conditions do water closets located in a barrier-free stall or washroom not require back supports?

   If equipped with seat lid or tank [3.8.3.9.(1)(c)]

8. What is the minimum dimension of a universal toilet room?

   1700 mm [3.8.3.12.(1)(f)]

9. If a Group B occupancy contains individual shower stalls, what is the required mounting height of a folding seat that is not spring loaded and is located in a barrier-free shower?

   The requirements are the same as those specified for assembly occupancies. 450 mm is the mounting height prescribed [3.8.3.13.(2) and 3.8.3.13.(1)(e)(ii)].

10. A bank of five wall-hung public telephones is provided in a mall entrance vestibule. Telephones are provided with counters at varying heights. How many counters are required to provide knee clearance as part of the barrier-free design requirements? What is the maximum height of the telephone receiver measured from the top of the counter that is required to be barrier-free accessible?

    At least one counter is required to be barrier-free. Telephone receiver height is 1200 mm – 865 mm = 335 mm [3.8.3.15.(2) and (3)].

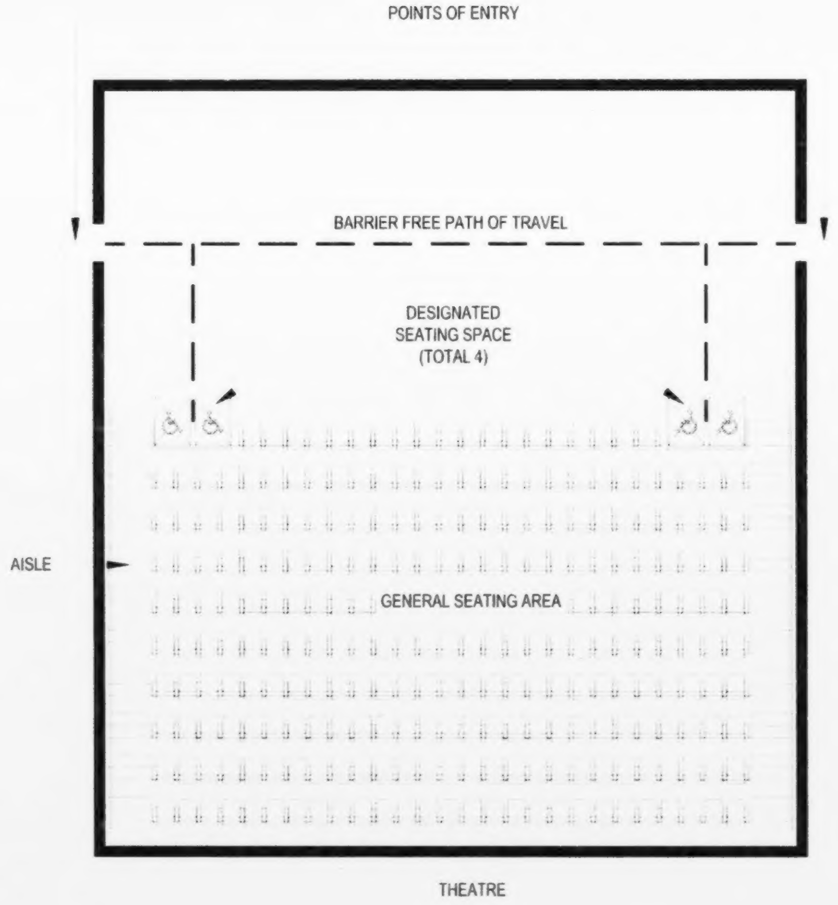

POINTS OF ENTRY
BARRIER FREE PATH OF TRAVEL
DESIGNATED SEATING SPACE (TOTAL 4)
AISLE
GENERAL SEATING AREA
THEATRE

FIGURE 11-6

MODULE 12

PORTABLE CLASSROOMS AND SELF-SERVICE STORAGE BUILDINGS

1. What is the maximum flame spread rating of a portable classroom?

   150, OBC [3.9.2.1.(1)]

2. What is the maximum area of a portable classroom?

   100 m² [3.9.3.1.]

3. What is the maximum number of portable classrooms allowed to be erected on a site before a fire alarm system has to be extended from the main school to the portable classrooms, if the portables are less than 6 m apart?

   12 [3.9.3.3.(2) and 3.9.3.3.(3)]

4. In a portable classroom with a fuel-fired appliance located 5 m from the egress doorway, and where the horizontal distance between classrooms is 8 m, is the fuel-fired appliance required to be separated from the remainder of the classroom?

   No [3.9.3.7.(3)]

EXERCISE #12-2

1. What occupancy must not be housed in a self-service storage building?

   Group F, Division 1 occupancy [3.10.2.1.(1)(b)]

2. In a nonsprinklered, single storey, self-service storage building, what is the maximum floor area of the storey before it is required to be subdivided?

   500m² [3.10.2.3.(2)]

3. What is the maximum travel distance in a rental space which does not incorporate a public corridor?

   15 m, OBC [3.10.2.4.(2)]

4. What is the minimum clear width of an exit stair in a self- service storage building?

   1100 mm [3.10.2.5.(2)]

5. In a two storey, self-storage building, is a fire alarm system required?

   Yes [3.10.3.3.(2)]

MODULE 13

PUBLIC POOLS AND PUBLIC SPAS

EXERCISE #13-1

1. A public pool operated by a mobile home park would be considered what Class of Pool?

   Class B, Clause 3.11.2.1.(3)(b)

2. In general, a public pool shall have a minimum water depth of?

   750 mm, Sentence 3.11.3.1.(4)

3. What is a requirement for a public pool deck to prevent access from the public?

   Public pool shall be equipped with lockable doors or gates, Sentences 3.11.3.1.(13) and (22)

4. When can an elevated platform be used instead of a pool deck?

   If the elevated platform surrounding the pool has a width of not less than 900 mm, a height of at least 75 mm above grade, 6 mm wide drainage openings and a non-slip, cleanable surface, Sentence 3.11.3.1.(11).

5. Every public pool shall have a sign posted notifying users of dangers associated with shallow water in pools with water depths below what depth?

   2500 mm, Sentence 3.11.3.1.(25)

EXERCISE #13-2

1. What must a diving board in a public pool that is more than 600 mm above the water surface be equipped with?

   One or more handrails, Sentence 3.11.4.1.(4)

2. What is the horizontal distance between the centre line of the diving platform and the closest vertical projection of a ledge where the platform is 500 mm above the water surface?

   3.0 m, Clause 3.11.4.1.(11)(a)

3. What is the minimum height of a handrail used on a ramp in a Group B Division 2 pool?

   800 mm - 900 mm in height, Clause 3.11.5.1.(3)(a)

4. Is a curb required in a Group B Division 2 pool? If so, what is the curb height?

   Yes - 50 mm, Clause 3.11.5.1.(3)(c) and Sentences 3.11.5.1.(5) and (6)

EXERCISE #13-3

1. What is the maximum slope of the bottom of a modified pool?

   8%, Sentence 3.11.6.1.(4)

2. What type of markings are required on the bottom of a modified pool?

   Continuous black contour lines, Sentence 3.11.6.1.(9)

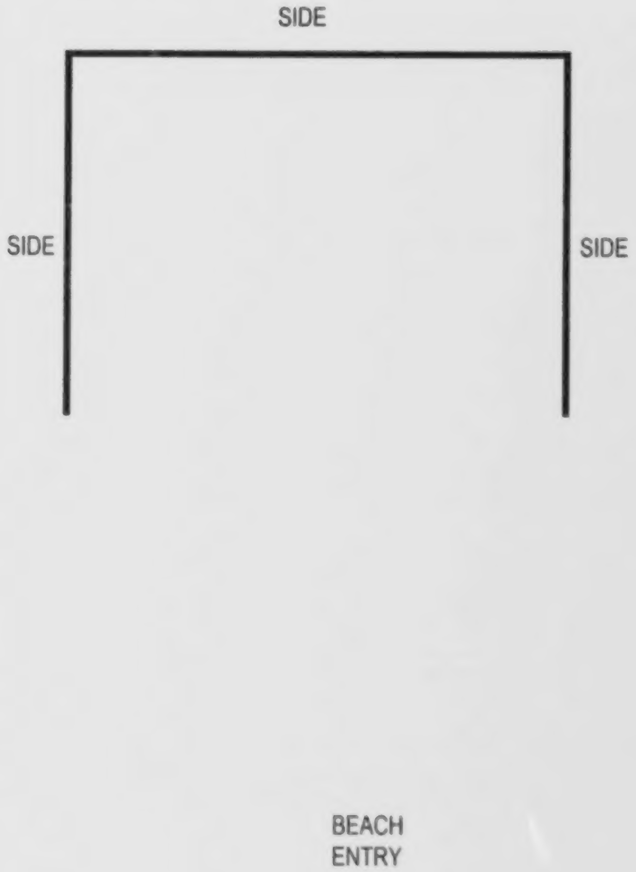
3. How many life guard control stations are required on each side of a wave action pool with a water depth of 1500 mm?

   At least two on each side, Sentence 3.11.7.1.(6)

4. In a wave action pool, what is the maximum distance a first aid room is permitted to be separated from the pool?

   50 m, Sentence 3.11.7.1.(11)

WAVE ACTION POOL EXAMPLE


SIDE
SIDE
SIDE
BEACH ENTRY

EXERCISE #13-4

1. In a Class B pool what is the volume of water required to be filtered and disinfected each day?

   4 times per total water volume of the pool per day,
   Clause 3.11.8.1.(5)(b)

2. Are water closets required for a Class A pool on the premises of a recreation camp if similar facilities are available elsewhere on the premises?

   No, Clause 3.11.9.1.(2)(a)

3. What are the illumination requirements for an outdoor pool deck after dark?

   100 lx and underwater areas of the pool shall clearly be visible from any point on the deck, Clause 3.11.10.1.(3)(a) and (b)

4. What is the air exchange volume requirement for mechanical ventilation in a service room where compressed chlorine gas is stored?

   30 air exchanges per hour [3.11.11 1.(2)(f)]

EXERCISE #13-5

1. What is the maximum depth of water for a public spa?

   1200 mm, Sentence 3.12.2.1.(2)

2. List three things a set of steps providing entry and egress from a public spa are required to have.

   a) handrail
   b) non-slip surface
   c) colour contrasting strips

   Sentence 3.12.2.1.(7)

EXERCISE #13-6

1. A water circulation system for a public spa with 5 m^3 of water volume shall be capable of disinfecting and filtering the water contained therein with a turnover period of how many minutes?

   20 minutes, Clause 3.12.4.1.(2)(b)

2. What is the maximum water velocity in a copper pressure pipe?

   1.8 m/s, Sentence 3.12.4.1.(12)(b)

3. Emergency telephones are required to be connected to an emergency service or the local telephone utility and installed within how many metres of the spa?

   30 m, Sentence 3.12.5.1.(2)

4. What is the minimum fire-resistance rating of a fire separation separating a compressed chlorine gas service room from the remainder of the building in a public spa?

   1 h, Clause 3.11.11.1.(2)(a)

MODULE 14

RAPID TRANSIT STATIONS

EXERCISE #14-1

1. Using Figure 14-1, what is the required fire-resistance rating of the assemblies shown? (Give Code reference)

   A 1 h rated roof assembly [3.13.2.1.(5) and 3.13.2.1.(10)(c)]
   B 1 h rated wall assembly or wired glass assembly [3.13.3.5.(1)(b))(i) and (ii)]
   C 2 h rated roof assembly [3.13.2.1.(3)(b)]

2. What is the exception to vestibule doors located in a 1 h fire separation or wired glass assembly between a rapid transit station and an adjacent building?

   Vestibule doors are not required to be equipped with latches [3.13.3.6.(3)(a)]

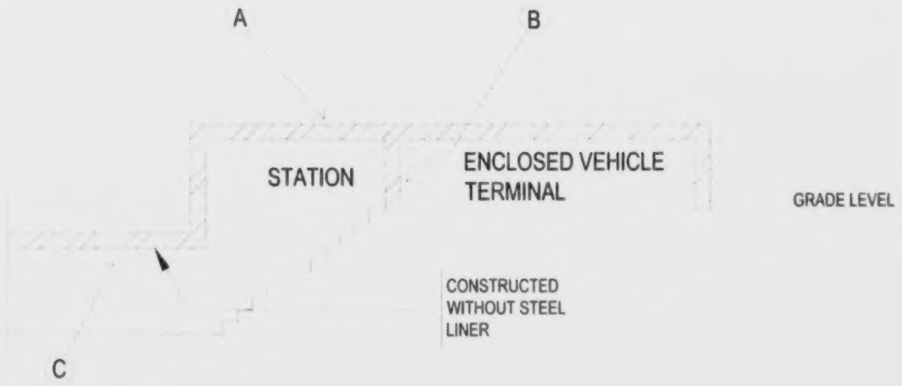

A
B
STATION
ENCLOSED VEHICLE TERMINAL
GRADE LEVEL
CONSTRUCTED WITHOUT STEEL LINER
C

FIGURE 14-1

3. Vestibule doors which separate a rapid transit station from an adjacent building are permitted to swing in either direction. True or False?

   False. Vestibule doors are required to swing in the direction of exit travel from the rapid transit station [3.13.3.6.(3)(b)]

4. What provisions specifically do not apply to a vestibule which connects a rapid transit station to an adjacent building?

   Additional requirements for high buildings (3.2.6.) and interconnected floor spaces (3.2.8.) do not apply to the rapid transit station [3.13.3.6.(6)].

EXERCISE #14-2

Using Figure 14-2, analyze the information provided and calculate the following:

Given:

- capacity of egress facility = flow rate x clearance time x egress width
- travel time to a protected egress route is 0.75 minutes
- clearance time is 3.25 minutes (i.e. 4 - 0.75 minutes)
- total egress width is 5 metres.

1. What is the maximum permitted capacity based on the pedestrian flow rate for stairs?

   Stairs - 55 persons/min/m [Table 3.13.4.5.]
   Time - 3.25 min
   Width - 5 m

   Capacity = (pedestrian flow rate in pedestrians/minute/metre width) 55 x 3.25 x 5 = approximately 894 people.

2. What is the maximum permitted capacity if the total egress width is increased to 7 metres in question 1.?

   Stairs - 55 persons/min/m [Table 3.13.4.5.]
   Time - 3.25 min
   Width - 7 m

   Capacity = (pedestrian flow rate in pedestrians/minute/metre width) 55 x 3.25 x 7 = approximately 1,251 people.

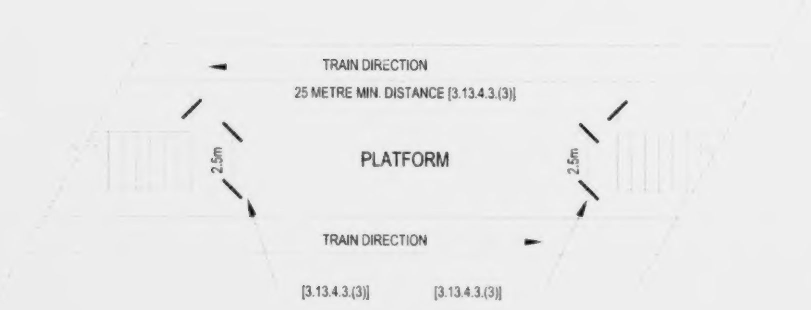

TRAIN DIRECTION
25 METRE MIN. DISTANCE [3.13.4.3.(3)]
2.5m
PLATFORM
2.5m
TRAIN DIRECTION
[3.13.4.3.(3)]
[3.13.4.3.(3)]

FIGURE 14-2

EXERCISE #14-3

1. In accordance with Article 3.13.5.2., what are the exceptions to Subsection 3.2.4., "Fire Alarm and Detection Systems"?

   Manual pull station and signal device requirements are not applicable in a rapid transit station [3.13.5.2.(1) and (2)].

2. In accordance with Article 3.13.5.9., under what circumstances are public telephones permitted to be used as emergency reporting devices?

   If the public telephones have a 'no charge' emergency capability and they are appropriately signed as such [3.13.5.9.(2)].

3. In accordance with Sentence 3.13.5.11.(6), what exemption exists for fire hose cabinets?

   Fire hose and fire hose rack requirements are not applicable in a rapid transit station.

EXERCISE #14-4

Read Article 3.13.6.2. and answer the question below.

1. All rapid transit stations are required to be provided with employee washrooms. True or false?

   False. Stations not staffed during operating hours are not required to be provided with employee washrooms [3.13.6.2.(3)].

EXERCISE #14-5

1. In accordance with Sentence 3.13.8.2.(1), when are elevators exempt from meeting the barrier-free requirements outlined in 3.3.1.7.(1)(a)?

   Elevators which are capable of providing transportation from each platform to a barrier-free entrance serving the rapid transit station [3.13.8.3.(1)].

2. In accordance with Sentence 3.13.8.5.(3), a washroom containing more than one water closet is required to be designed such that each water closet is barrier-free. True or false?

   False. Only one water closet is required to meet the barrier-free requirements [3.8.3.8.(1)].

MODULE 15

TENTS
AIR-SUPPORTED STRUCTURES
SIGNS
SHELF AND RACK STORAGE SYSTEMS

EXERCISE #15-1

1. Tents having an area greater than 225 m^2 are required to conform to which of the following requirements?

a) means of egress	*Yes, [3.14.1.3.]*
b) clearance to other structures	*Yes, [3.14.1.4.]*
c) flame resistance	*Yes, [3.14.1.6.]*
d) provision for firefighting	*Yes, [3.14.1.9.]*

2. How close can a tent be located to a building, other tents or a property line?

   3 m, [3.14.1.4.(1) and (2)]

   Are there any exceptions to the 3 m clearance in Question #2?

   Yes, tents not occupied by the public and tents located on fair grounds, provided spacing does not create a hazard to the public [3.14.1.4.(4) and (5)].

3. What flammability standard is a tent fabric required to be tested to?

   CAN/ULC-S109, "Flame Tests of Flame-Resistant Fabrics and Films" or NFPA 701, "Fire Tests for Flame-Resistant Textiles and Films" [3.14.1.6.(1)].

EXERCISE #15-2

1. The owner of an industrial building intends to install an air-supported structure for the purpose of storing highly hazardous materials. The structure will be connected to the building by a walkway. Is this permitted?

   No, Air-supported structures are not permitted to be used for Group F, Division 1 building major occupancies [3.14.2.2.(1)].

2. An air-supported structure may be attached to another building where the building:

   a) consists of a maximum area of 200 m^2
   b) is sprinklered or is separated from the air-supported structure by a fire separation having a 1 h fire-resistance rating
   c) conforms to the requirements of other Parts of the Code based on the building area of the building.
   d) has all of the above.

   (d) [3.14.2.3.(3)]

3. When is an emergency air supply required for an air-supported structure?

   Air-supported structures designed for an assembly occupancy with an occupant load of more than 200 persons [3.14.2.6.(1)].

4. Are air-supported structures permitted to have a mezzanine constructed as part of the intended occupancy?

   Yes. Air-supported structures may be designed with mezzanine and internal walls or similar construction [3.14.2.2.(4)].

   Interior construction must meet the construction requirements of 3.2.2.20. to 3.2.2.83. [3.14.2.2.(5)].

EXERCISE #15-3

1. Most signs are required to be designed in accordance with Part 4. True or false?

   True: [3.15.3.1.(1)]

2. A non-metallic sign having a plastic face is located on the exterior wall of a building. The exterior wall is of noncombustible construction. The sign is approximately 40% of the building wall area and projects 600 mm over a public sidewalk. The sign is located 2395 mm above the sidewalk.

   Is the sign permitted in such a location? Yes or no, and explain why.

   No, The sign exceeds the permitted area by 10% [3.15.4.1.(2)(a)] and the sign is less than the allowed height above a public sidewalk 2400 mm minimum, [3.15.5.2.(1)].

3. Is a sign painted directly on a building subject to the provisions of Section 3.15.?

   Signs painted directly onto a building are exempt [3.15.1.2.(1) (d)].

4. What type of sign is permitted to obstruct a means of egress or required access for firefighting?

   No sign is permitted to be located so as to obstruct a required means of egress or an access required for firefighting [3.15.5.1.(1)].

5. What is the permitted maximum average burn rate of 1.5 mm thick plastic, used in the construction of a sign face when tested in a horizontal position, and to what standard is the plastic tested?

   The plastic shall have a burn rate not greater than 65 mm/min, and shall be tested in accordance with ASTM D635, "Rate of Burning and/or Extent and Time of Burning of Self-supporting Plastics in a Horizontal Position" [3.15.4.1.(1) (a)].

EXERCISE #15-4

1. What is the maximum travel distance on an elevated platform including unenclosed stairs?

   45 m [3.16.1.7.(4)]

2. What is the maximum height of a shelf and rack storage system used to store rubber tires?

   7 m [3.16.3.2.(3)]

MODULE 16

ADDITIONAL REQUIREMENTS FOR CHANGE OF USE AND RENOVATIONS

EXERCISE #16-1

1. From the information in Table 1.3.1.4., Part 1, Division C, is a permit required if the major occupancy of a building is changed from a residential occupancy to a mercantile occupancy?
   Yes, [Clause 3.17.1.1. (1)(a)]

2. If a farm building is changed to an industrial occupancy, is a building permit required?

   Yes, [Clause 3.17.1.1. (1)(d)]

3. Consider a residential building which is being converted into an office building. Do the requirements in the Code for a Group D occupancy apply to the washroom facilities in the renovated building?

   Yes, [Sentence 3.17.2.1.(1)]

4. The performance level after construction shall:

   a) be less than the performance level of the building prior to construction

   b) not be less than the performance level of the building prior to construction

   c) not have a construction index more than prior to construction

   d) shall be equal to the performance level of the building prior to construction.

   b) [Sentence 3.17.2.2. (1)]

5. What Articles and Sentences describe the factors that determine a reduction in performance level?

   Articles 11.4.2.1., 11.4.2.3., 11.4.2.5. [Sentence 3.17.2.2.(2]

EXERCISE #16-2

1. What is a Part 11 Compliance Alternative for Article 3.2.4.21. which states that all smoke alarms are to be hard wired?

   Such smoke alarms may be battery operated
   [Table 11.5.1.1 C. # C18]

2. In which Part of the Code may a compliance alternative be substituted for a Code requirement without having to satisfy the chief building official?

   Part 9 of the Code [Sentence 11.5.1.1.(2)]

MODULE 17

PART 5
ENVIRONMENTAL SEPARATION

EXERCISE #17-1

1. In Section 5.2, how are interior environmental loads derived?

   Loads derived from the intended use of the space [5.2.1.2.(1)]

2. To what Subsection of the Code shall wind load calculations conform?

   Subsection 4.1.7. [5.2.1.3.(3)]

EXERCISE #17-2

1. Refer to Article 5.3.1.2. and list the types of windows and doors that are exempt from the requirement for thermal break. Give Code reference.

   Metal framed storm windows or doors, or windows and doors required to have a fire protection rating [5.3.1.2.(3)].

2. Refer to Section 5.10. To what CAN/CGSB Standard shall "Thermal Insulation, Phenolic, Faced" conform when installed to provide the required resistance to heat transfer? Give Code reference.

   CAN/CGSB-51.25-M [Table 5.10.1.1.]

EXERCISE #17-3

1. What is the purpose of an air barrier system? Give Code reference.

   a) limit the spread of smoke
   b) resist heat transfer
   c) provide the principal resistance to air leakage, or
   d) minimize moisture transfer

   c) [5.4.1.1.(2)]
2. What is the maximum permitted air leakage characteristic of a material used as an air

barrier?

0.02 L/(s•m^2) measured at an air pressure difference of 75 Pa [5.4.1.2.(1)]

EXERCISE #17-4

1. Where is a vapour barrier required in a building component or assembly?

   Where a building component or assembly will be subjected to differentials in temperature and water vapour pressure [5.5.1.1.(1)]

2. For what purpose is the Standard ASTM E96 used?

   To determine whether coatings applied to materials other than gypsum wallboard conform to 5.5.1.2.(2) re: permeance [5.5.1.2.(3)]

EXERCISE #17-5

1. In Article 5.6.1.1., what are the basic requirements for a building component or assembly exposed to precipitation?

   a) *minimize ingress of precipitation into the component or assembly, and*
   b) *prevent ingress of precipitation into interior space.*

2. What standard applies to the installation of an asphalt shingle roof with a slope 1:6 to less than 1:3?

   CAN 3-A123.52-M [5.6.1.3.(1)(d)]

EXERCISE #17-6

In Section 5.8, under what circumstance is it not necessary to install materials that prevent moisture transfer from the ground to interior space?

Where such transfer will not adversely affect

a) *health or safety of building users*
b) *intended use of the building, or*
c) *operation of building services[5.8.2.1.(2)]*

Ontario

Ministry of Municipal Affairs and Housing

PARTICIPANT / SELF-STUDY

APPENDIX A

LARGE BUILDINGS - 2006

ADDITIONAL STUDY MATERIALS

This course material may assist you in preparing for writing the Ministry exams, however, it is strongly suggested that you also refer to the Qualification and Registration pages on the Building Code website (www.ontario.ca/buildingcode) for detailed examination syllabi, as well as reading and reviewing the Code.

A.1 INTRODUCTION

As indicated in Module 1, the 2006 edition of the Ontario Building Code has been reformatted and is now written in an objective-based format.

The following examples provide an illustration of how "Alternative Solution" approaches [Div A, Part 1, Sentence 1.2.1.1.(1)(b)] may be presented together with guidance on how to find the applicable objective and functional statements in Supplementary Standard SA-1.

Examples indicate by Module Number and Section, where the material appears in the Large Buildings training course.

Example of Alternative Solution Approach

If a designer wished to utilize the "Alternative Solution" approach to the requirements in Sentence 3.3.1.4.(1), according to Sentence 1.2.1.1.(1)(b),[Division A, Part 1], one means of demonstrating compliance with the prescriptive "*acceptable solutions*" in Division B of the Code, is to use an "*alternative solution*" that will achieve the level of performance required by the applicable *acceptable solution* in Sentence 3.3.1.4.(1) in respect of the *objectives* and *functional statements* attributed to the applicable *acceptable solution* in Supplementary Standard SA-1. For the purpose of 1.2.1.1.(1)(b), the level of performance in respect of a *functional statement* refers to the performance of the *functional statement* as it relates to the *objective* to which it is associated in Supplementary Standard SA-1. This is the principle behind the new "Objective-Based Code".

In Division C, Part 2 of the OBC, Article 2.1.1 "Documentation of Alternative Solutions" describes the documentation that must be provided to the chief building official to demonstrate that the proposed *alternative solution* will achieve the level of performance required under Article 1.2.1.1. of Division A of the Code. This documentation includes a rationale to compare the performance of the proposed "alternative solution" design with a design that is known to be acceptable.

1. For Sentence 3.3.1.4.(1), the applicable objective and functional statements are shown in Table 1.

2. The designer wishes to submit an "alternative solution" as follows (refer to Figure A -1).

3. In lieu of providing a fire separation that is continuous from ground floor to the underside of the second floor between a public corridor and the remainder of the storey in a two-storey sprinklered office building (Group D), the designer proposes to use a fire separation that is not continuous vertically to the underside of the second floor, but one that terminates at a ceiling that by utilizing sealants provides a

continuous separation between the public corridor and the remainder of the storey.

In the submission, the designer would need to demonstrate that the fire and smoke barrier properties of the proposed separation is at least equivalent to that of a continuous floor-to-floor vertical fire separation on each side of the public corridor. Test information such as that found in Supplementary Standard SB-2 Fire Performance Ratings, or in the ULC fire-resistance directory could be used to show that the membrane used provides a fire separation both when installed vertically and horizontally.

Such a submission would demonstrate that the objectives and functional statements in Table 1 have been satisfied by the "alternative solution".

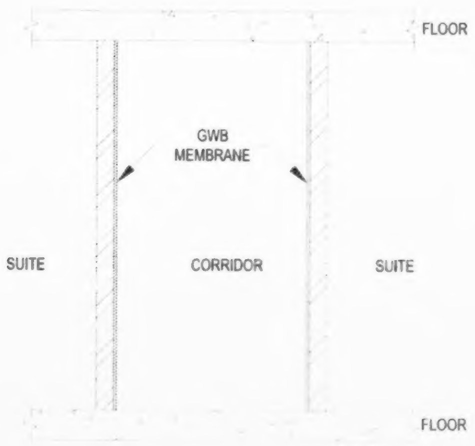
STOP

TABLE 1

Objective Statements	Functional Statements
OP1 - Fire, Structural, Water and Sewage Protection of Buildings – Fire Protection of the Building	
OP1.2 – An objective of this Code is to limit the probability that as a result of its design or construction, a building will be exposed to an unacceptable risk of damage due to fire, caused by fire or explosion impacting areas beyond its point of origin.	**F03** – To retard the effects of fire on areas beyond its point of origin. **F06** – To retard the effects of fire on facilities for notification, suppression and emergency
OS1 – Safety – Fire Safety	
OS1.2 – An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by fire or explosion impacting areas beyond its point of origin.	**F06** – To retard the effects of fire on facilities for notification, suppression and emergency
OS1.5 - An objective of this Code is to limit the probability that as a result of the design or construction of a building, a person in or adjacent to the building will be exposed to an unacceptable risk of injury due to fire caused by persons being delayed in or impeded from moving to a safe place during a fire emergency.	**F03** – To retard the effects of fire on areas beyond its point of origin. **F05** – To retard the effects of fire on emergency egress facilities **F06** – To retard the effects of fire on facilities for notification, suppression and emergency

Fire Separation of Public Corridor from Remainder of the Storey 3.3.1.4.(1)

ACCEPTABLE SOLUTION


FLOOR
GWB
MEMBRANE
SUITE
CORRIDOR
SUITE
FLOOR

ALTERNATE SOLUTION

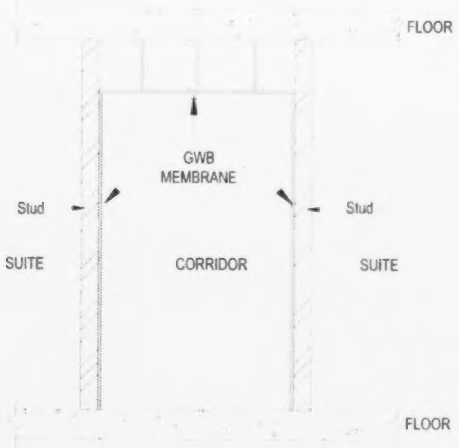

FLOOR
GWB
MEMBRANE
Stud
Stud
SUITE
CORRIDOR
SUITE
FLOOR

FIGURE A-1

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